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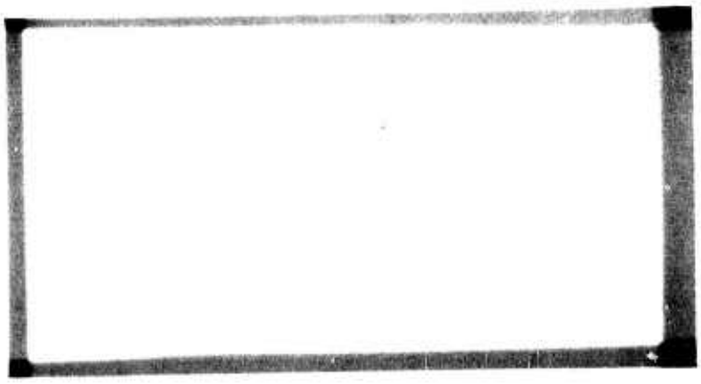

A STUDY OF CIVILIAN RETIREMENTS WITHIN THE HEADQUARTERS OF THE AIR FORCE LOGISTICS COMMAND AND THE 2750TH AIR BASE WING

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A STUDY OF CIVILIAN RETIREMENTS WITHIN THE HEADQUARTERS OF THE AIR FORCE LOGISTICS COMMAND AND THE 2750TH AIR BASE WING

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INTRODUCTION

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Problem Statement

AFLC managers engaged in personnel planning have expressed a need for a model that could be used to predict the date a given civilian employee might be expected to exercise his retirement option. In recent years, losses due to retirement comprised 20-30 percent of all AFLC civilian personnel losses. When across-the-board personnel cuts have occurred, numerous planning problems were created when losses through attrition could not be adequately projected. These problems were magnified because no reliable method for predicting retirements was available.[1] Specifically, a mathematical model capable of predicting civilian retirements with an improved degree of accuracy would be invaluable in managing the large AFLC civilian workforce.[2]

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[1]Wright-Patterson AFB, Ohio. Personal interview with Mr. Harry D. Wilfong, Chief, Civilian Personnel Research Office; and Mr. A.J. Palumbo, Staff Psychologist, Headquarters AFLC. Wright-Patterson AFB, Ohio. 14 December 1970.

[2]Palumbo, A.J. "Analysis of Factors Leading to Civilian Employee Decisions to Exercise Their Retirement Option." Logistics Research Proposal No. 154, School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB, Ohio. 1970.

Background

Under current civil service regulations, an employee is eligible for optional retirement on an immediate annuity if he is: (1) age 62 with five years of civilian service, (2) age 55 with 30 years of creditable service including five years of civilian service, or (3) age 60 with 20 years creditable service including at least five years civilian service. Also, options for a lower retirement age are available under certain circumstances but with reduced benefits.[1]

In addition to the wide variations in possible retirement age based on length of service, we can add a number of other variables which may or may not affect one's decision to exercise his retirement option. Research in this area disclosed a limited number of studies which attempted to determine those variables affecting retirement planning. Other personnel studies reviewed by the author simply projected retirements based on the total number of those eligible for retirement over a selected period of time. However, it could not be determined that a study had ever been made of Federal Government civilian employees in which an attempt was made to construct a predictive retirement model based on variable factors

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[1]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 27.

determined to be pertinent to the retirement decision. Prior research efforts paralleling, to some extent, those of this study are discussed in the following briefs.

A 1968 doctoral dissertation at Iowa State University investigated retirement anticipation variables of Army personnel. Data was obtained by the use of mail questionnaires to 1286 active duty members; a 57 percent response rate was obtained. Variables looked at included: military rank, health conditions, pre-retirement training, years of service, financial status, morale, career satisfaction, job expectations, age, number of dependents, income, preparation for retirement, special training, breaks in service, permanence of work, social life, attitude toward retirement, and orientation toward retirement.[1]

Analysis of the data collected was accomplished through the use of simple correlation, partial correlation, and chi square statistical methods. Significant differences between military retirement anticipation and selected independent variables were tested for by means of the Student t test.

The research indicated that health was not an important factor influencing retirement plans, but that education definitely was an important influencing factor.

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[1]Stanford, E. Percil, Ph.D. Anticipation of Retirement by Military Personnel. Iowa State University, 1968.

Variables found to be insignificant at the .05 level, when using correlation or chi square analysis, were attitudes toward retirement, social life, and orientation toward retirement. Oddly, anticipation of retirement was not found to be unfavorable for those persons who said they would miss military social life.[1]

A recent Air Force study conducted at the Ogden Air Materiel Area (OOAMA) disclosed that 45.1 percent of the 1967 civilian workforce would be eligible for retirement by 1981. Of even more interest was the revelation that 93.8 percent of GS-14 and GS-15 level personnel, and 58.3 percent of all OOAMA managers, would be eligible to retire by 1981 or before.[2]

Those becoming eligible to retire for the first time represented a small annual percentage figure of less than 2 percent up to 1971, with an expected peak of 4 percent in 1978. However, if present retirement laws were changed to permit retirement based on 30 years service, regardless of age, a 4.5 percent peak in the annual rate of those becoming eligible to retire would be attained in 1972. By 1973 a total of 1400 OOAMA employees would be eligible

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[1] Ibid.

[2] "Retirement Eligibility and Projections." An unpublished set of charts developed as a part of Project HIPRO. Hill AFB, Utah, 1968.

for retirement based on 30 years service. Under a "30 year law" all the GS-15 and GS-16 and more than one-half the GS-14 employees would be eligible to retire by 1975.

In analyzing the data collected, it was determined that there were 653 OOAMA personnel who were eligible to retire under present laws by 1967 but who had not chosen to do so. Questionnaires were sent to all personnel who would be eligible to retire within a few years of the time of the study to determine their plans for retirement. The results of the survey disclosed that OOAMA employees planned to work an average of three years after becoming eligible for retirement.[1]

In a non-government study of men retired five years or longer, it was found that 14 percent of them would have liked to retire earlier than they did. The study further disclosed that three out of four private pension plans allowed employees to retire before age 65. However, it was found that about 25 percent of a group of companies polled by the National Industrial Conference Board allowed employees to work past age 65 if they were doing a satisfactory job.[2]

The study pointed out that approximately one-fourth of the men and women age 65 and older worked either

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[1] Ibid.

[2] "When Should You Retire?" Changing Times, Vol. 19, No. 5, May 1965, pp. 31-33.

part-time or full-time. Over one-fifth of the men surveyed worked full-time. It was also found that about four out of every ten men retired because of poor health.[1]

Another non-government survey, of 1853 families with heads in the 35 to 64 age group, studied the importance of retirement income on family retirement planning. Most of the families studied foresaw no financial problems in retirement because of their confidence in social security and private pension plans. Nearly all of the families surveyed were covered by social security, railroad retirement, or government pension plans, but less than half participated in private pension plans. Those that were enrolled in private plans generally expected a retirement pension from the plan of $150 a month or less. Approximately 27 percent of the test group believed that social security alone would satisfy their retirement needs. About 50 percent of the survey group planned to supplement their retirement income by part-time employment. One-third of the group expected to receive some income from life insurance, annuities, or similar sources.[2]

The study pointed out that people in ever-increasing numbers are retiring earlier. Half the men awarded social security benefits in 1964 retired before they were 65

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[1] Ibid.

[2] "The Decision to Retire: A Canvass of Possibilities." Monthly Labor Review, Volume 89, No. 1, January 1966, p. 89.

years old, and consequently, for the most part, were receiving permanently reduced benefits. The Social Security Administration's 1963 "Survey of the Aged" showed nearly 75 percent of the beneficiaries age 62 to 64 had retired involuntarily. The younger group was also more likely to have had a decline in earnings from their peak earning year. A substantial number of them reported no earnings at all the year before retirement.[1]

A study conducted by the Social Security Administration in 1965 explored three basic questions: (1) the impact of earning capacity on the decision to retire; (2) the impact of the retirement test (i.e. criteria for determining retirement eligibility) on the labor force activity of the aged; and (3) the impact of the old-age, survivors, and disability insurance (OASDI) program on the allocation of human resources. Of most interest to this study was the finding that those with high earning capacity were less prone to retire than those with low earning capacity. This, of course, was consistent with the structure of OASDI benefits which replace a larger proportion of the earnings of those with low earning capacities.[2]

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[1] Ibid.

[2] Gallaway, Lowell E. The Retirement Decision: An Exploratory Essay. Social Security Administration Research Report No. 9, U.S. Department of Health, Education, and Welfare, June 1965.

Other related research included a 1965 RAND study which collected civilian personnel data at the Oklahoma City Air Materiel Area (OCAMA) for a one-year period beginning 10 August 1963. The study was conducted for the purpose of developing a quantitative model predictive of personnel distributions over a five year period for variables such as grade, age, seniority and skills levels.[1]

One of the findings of the study indicated that the potential retirement problem of OCAMA personnel was not an immediate one of the magnitude of the predicted reduction in younger members of the workforce during the five year period being considered (1965 through 1969). However, the study concluded that the post prediction period could have a large concentration of potential retirements if requirements for retirement with respect to age and seniority were subsequently reduced.[2]

Harding and Merck made a study in which they applied Markov chain theory to the prediction of officer retirement rates. Their chain of career states was based on the total years of military service of a selected group of regular Air Force rated and non-rated officers. They attempted to project group retirement rates of officers,

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[1]Fishman, George S. Predicting Personnel Structures, Part I: General Model and Application to OCAMA's Age and Seniority Distributions. The Rand Corporation, Memorandum RM-4471-PR, April 1965.

[2]Ibid.

categorized by flying status and career area, based on actual changes occurring during the first half of 1962. Their paper demonstrated the feasibility of applying Markov chains to predicting retirement rates. However, they concluded that broader and more complex input information would be required to provide projections that would actually be of use in military personnel planning.[1]

Scope

This study was limited to optional retirements and selected factors influencing retirement of civilian employees of the Air Force Logistics Command Headquarters and the 2750th Air Base Wing, Wright-Patterson AFB, Ohio, during calendar years 1968, 1969, and 1970. Wageboard and classified act employees of all grades retiring during the selected time period were studied. Retirement decision variables considered in the study included: age, sex, marital status, age of spouse, health, employee classification, grade, length-of-service, home at the time of applying for retirement, receipt of military retired pay, number of years eligible for retirement, and influence of increased annuities brought about by cost of living adjustments. The list of variables tested was not intended to represent all those variables affecting a given

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[1]Harding, Francis D. and John W. Merck. Markov Chain Theory Applied to the Prediction of Retirement Rates. 650th Personnel Research Lab, Aerospace Medical Division, Lackland AFB, Texas, June 1964.

individual's decision to retire, but included those factors considered pertinent to the research effort that were readily available to the researcher.

Objectives

The objectives of this research effort were twofold:

1. To determine those variable factors that can best be used in predicting the age at which a given AFLC civilian employee might elect to exercise his retirement option.

2. To construct a mathematical model based on data collected from recently retired AFLC personnel that could be used to project future civilian workforce retirements.

Hypotheses

The following hypotheses were statistically tested by means of appropriate parametric and non-parametric analysis:

1. The mean optional retirement age of AFLC civilian employees differs significantly from that age, 62 years, where nearly all employees will have, in fact, become eligible for retirement.[1]

2. There is a significant difference in the average retirement age of AFLC personnel with respect to sex,

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[1]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970. p. 27.

marital status, grade, and employee classification.

3. AFLC personnel retiring for health or disability reasons choose optional retirement at a mean age below that of employees in good health.

4. There is a significant difference in the average retirement age of AFLC Headquarters personnel and personnel of the 2750th Air Base Wing.

5. Civilian employees receiving military retired pay do not retire at the same average age as those not receiving military retirement benefits.

6. Personnel retiring to homes outside of the Dayton area retire earlier than those making their retirement home in the State of Ohio.

7. Age of spouse, the length of time eligible for retirement, and total years creditable federal service, both civilian and military, are correlated to the age of retirement.

8. The number of retirements increases significantly during periods when increased cost of living allowances (COLA) are applicable.

Chapter 2

METHODOLOGY

Procedure

Nature and Source of Data

The primary source of data for this study was Standard Forms 2801, Application for Retirement, on file at the 2750th Air Base Wing Civilian Personnel Branch, Wright-Patterson AFB, Ohio. A secondary source included work-papers, notes, physician certificates, etc., included in the individual retirement files. The data collected represented all optional retirements of AFLC Headquarters and 2750th Air Base Wing civilian personnel during calendar years 1968, 1969 and 1970; retirements from tenant units were not included. A total of 484 optional civilian retirements was analyzed in the study, including 139 occurring during 1968, 184 in 1969, and 161 in 1970.

Data for the study were limited to that information contained on the Standard Forms 2801. Variables considered relevant to the study that were available from the Standard Forms 2801, or that could be computed from the information available, included: age of retirement; address at the time the Application for Retirement was completed; sex;

marital status; age of spouse; length of time eligible for retirement; length of federal service, including both military and civilian service; grade; employee classification, i.e. wageboard or classified act; military retired pay; and whether or not health or disability reasons were involved in the retirement decision. Variables that were desired for the study but were not readily available included: time in grade, rate of progression, salary, home ownership in the Dayton area, non-government business interests, and length of time spent in the area. One of these, salary, should be directly correlated to employee classification and grade; therefore, its absence from the study is not considered to be very significant.

Data Collection Techniques

Data for the research effort were collected by manually extracting relevant information from the Standard Forms 2801 and other applicable sources and recording it on a multiple column worksheet. The variables of interest were then coded by a predetermined coding system and keypunched into IBM cards so that the data collected could be analyzed via a computer and sorted as necessary for testing the various hypotheses of the study. The appendix of this paper contains a complete print-out of the researcher's coded data.

Analysis and Hypothesis Testing

The analysis of data from the sample included computing arithmetic means, variances of the mean, and standard deviations for various characteristics of interest to the study. The author used extensively the GE-600 computer system within the AFLC Headquarters facilities at Wright-Patterson AFB in analyzing sample data and in conducting appropriate hypotheses tests. The computer programs used were written by the author in the FORTRAN programming language; programs were manually checked to determine the integrity of the outputs received from the computer.

The eight researcher's hypotheses stated earlier were tested at the 5 percent level of significance by means of appropriate statistical tests utilizing the data collected. Where results were not significant at the .05 level, a level of significance at which the results would be applicable was stated in the findings where deemed appropriate to the study.

The Student t test was employed to test the first hypothesis stated in the null form: The mean optional retirement age of AFLC civilian employees is 62 years of age. The t value computed allowed 483 degrees of freedom due to the large sample size of 484. In order to use the Student t test, the author had to make the assumption that the underlying distribution of the parent population

was normally distributed. However, this appeared to be a very valid assumption as the sample data supported quite well a normal distribution fit.

The second hypothesis was stated in the null form for testing: The average retirement age of AFLC personnel is the same with respect to sex, marital status, grade, and employee classification. The Mann-Whitney U test was used to test separately each of the variables in the null hypothesis. The grade variable was tested separately for wageboard and classified act employees. Wageboard retirees were grouped into two broad classes: those in grades W-10, L-8, or F-5 and below; and those in grades W-11, L-9, or F-6 and above. Leaders and foremen were grouped with nonsupervisory employees on the basis of comparable annual salaries. Thus, the groupings used for the hypothesis test were roughly made up of those wageboard retirees earning annual salaries of $10,000 and above, and those earning somewhat less than that figure. The salary scale used in making the class determinations was one that went into effect at Wright-Patterson AFB on 29 March 1970. Classified act employees were separated for testing at grade GS-11 and below, and those graded at GS-12 or higher at the time of retirement. The U test was used because it requires no parametric assumptions to be made as do the Normal or t tests and because it has a power efficiency of 95 percent of the t test, thereby

rendering it one of the most powerful and most useful of all the nonparametric statistical tests.

The Mann-Whitney U test was also employed to test the third, fourth, fifth, and sixth null hypotheses stated: (1) AFLC personnel retiring for health or disability reasons choose optional retirement at a mean age equal to or greater than that of employees in good health; (2) The average retirement age of AFLC Headquarters personnel is the same as that of 2750th Air Base Wing employees; (3) Civilian employees receiving military retired pay retire at the same average age as those not receiving military retirement benefits; and (4) Personnel retiring to homes outside of the Dayton area retire at the same age as those making their retirement home in the Dayton area.

The sixth hypothesis was tested by means of the Spearman Rank Correlation Coefficient test. Separate tests were made in determining if there was a direct or inverse correlation between retirement age and age of spouse, retirement age and total years federal service, and retirement age and length of time retiree was eligible for retirement. The null hypothesis was stated: The coefficient of correlation (r) is equal to zero when age of retirement is tested for correlation to age of spouse, length of service, and length of time eligible for retirement. As the sample size was large for all three of the tests performed, the coefficient of correlation had

to be converted to the t statistic. A table of values for use with the Student t test was then utilized as the basis for rejecting or not rejecting the null hypothesis. The t values computed allowed for 482 degrees of freedom in the case of the tests involving length of service and length of time eligible for retirement, and for 354 degrees of freedom in the test involving age of spouse. The reduction in the latter case was due to the number of married retirees being only 356.

The Student t test was again employed to test the final research hypothesis stated: The number of optional civilian retirements can be expected to decrease or remain the same during periods preceding an increased cost of living allowance to the retirement annuity. A mean number of optional retirements per month was computed for the three years sampled in the study. The mean number of retirements per month of the four individual months which preceded a COLA during the three years was then computed and tested against the mean for the entire sample space. The t value computed allowed for three degrees of statistical freedom. To use the Student t test, it was again necessary to make the assumption that the parent population followed a normal distribution. A Fisher G test was used to test the null hypothesis stated: The number of retirements per month over the duration of the sample space (36 months) is normally distributed.

The first objective of the research paper was accomplished, within the limits imposed by data availability, by presenting the results of the hypotheses testing. Conclusions reached about the variables that enter into the retirement decision, and about those factors that can be used to predict optional retirements, are presented in Chapter 3 of this paper.

Model Construction

Upon determining via the hypotheses testing those variates that are directly or inversely, as the case may be, correlated to the age of retirement, the author had at his disposal what appeared to be a reasonably sound basis for constructing a model to be used for predicting the retirement age of AFLC civilian employees. The approach used in constructing the model is described below; the detailed results and final form of the mathematical model itself are presented in Chapter 4 of this paper.

The researcher decided upon regression analysis as the most likely approach to arrive at a mathematically and statistically sound model that might win acceptance as meeting the second objective of this research effort. The first step taken in this direction was to select, by means of a table of random digits, a random sample of 75 of the 484 retirements being studied. That accomplished, the author then determined the most likely functional

relationship between each of the variates to be used in predicting retirement age, and retirement age itself. This was accomplished by making use of the CURFIT program in the GE-600 Line Time-Sharing Library of Programs.[1] The CURFIT program fits six different curves by the least squares method to the data points of a sample space in its search for a "best fit" regression line. The functional relationships tried included three hyperbolic equations and one each linear, power, and exponential equation of the regression line. The most likely functional relationship between the Y variate (age of retirement) and the variates used as predictors was determined by selecting the highest value of the index of determination (r^2) corresponding to each of the six regression lines fit to the sample points.

Having determined the best functional relationships for constructing individual regression lines, the author proceeded to develop a regression model including all 484 data points from the retirement sample. A multiple regression computer program developed by Lt. Colonel F.E. James[2] was used for this purpose. The actual model building

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[1] GE-600 Line Time-Sharing Library Programs. Technical Manual CPB-1694. The General Electric Co., July 1970.

[2] James, Francis E., Jr., Lt. Colonel, USAF, Ph.D. A Matrix Solution for the General Linear Regression Model. Technical Report No. 4. Air University, Air Force Institute of Technology, School of Systems and Logistics, Wright-Patterson AFB, Ohio, May 1969.

was "tackled" by making a series of computer runs. The first run included all data points; the regression line was constructed using only the best of those factors determined to be correlated to the age of retirement. Subsequent computer runs were then made adding one more predictor each run to determine if the addition of data to the basic model made a contribution toward improving the reliability of the model being developed.

After hitting upon the best multiple regression model that could be determined for the complete sample, i.e. that model which contained the highest coefficient of determination (r^2), various segments of the population such as the higher graded GS employees versus the lower graded GS employees were broken out in an effort to determine if a slightly better model could be fit to the data points. Subgroups were tested where it had been determined that the mean age of retirement of one group differed significantly from that of another subgrouping in the hypotheses testing. Where better models than the general model developed for all civilian employees were found, they are presented in Chapter 4, as are the detailed findings and conclusions of the researcher's effort to construct a suitable retirement model. For all the models developed, the significance of the overall regression was tested by means of the F statistic.

Chapter 3

ANALYSIS OF RETIREMENT DECISION VARIABLES

Overview

The first stated objective of this research paper was to determine the primary factors which enter into the retirement decision of AFLC civilian employees. This chapter is devoted to looking at those factors such as age, sex, marital status, and length of service to determine what bearing, if any, they might have upon the decision to retire. The source of data for the comparisons and statistical analyses presented in this chapter was a sample of 484 optional civilian retirements of AFLC Headquarters and 2750th Air Base Wing personnel. The sample included all optional retirements of GS and wage-board employees of the two organizations during calendar years 1968, 1969, and 1970. Standard Forms 2801, Application for Retirement, served as the primary source document of the information analyzed.

Throughout this chapter, age of retirement was used as the basis for tying everything together, as it offered the best medium for determining whether or not various characteristics of interest to the researcher reflected significantly different retirement patterns among AFLC

employees. Also, age of retirement appeared to be the best variate available for constructing a meaningful predictive retirement model (See Chapter 4). The results of testing the eight researcher's hypotheses are presented in this chapter, as are the author's comments on the significant findings of the study.

Variables in the Retirement Decision

Since questionnaires or interviews with retirees were not performed in this study, all inferences about the decision to retire and the factors weighing upon that decision had to be made from a statistical analysis of the characteristics of the sample population of retirees. Those factors determined to have a possible influence upon one's decision to retire included: (1) age, (2) sex, (3) marital status, (4) employee classification, (5) grade, (6) health, (7) organization, (8) receipt of military retirement pay, (9) home at the time of applying for retirement, (10) age of spouse, (11) length of retirement eligibility, (12) length of service, (13) applicability of cost of living allowances (COLA), and (14) other factors for which data was not available to the researcher.

Age

Because of current civil service regulations allowing retirement at age 55 with 30 years federal service, at

age 60 with 20 years service, and at age 62 with at least 5 years of civilian service,[1] the author had hypothesized that the mean retirement age of all AFLC employees would most likely be somewhere around 62 years. However, the sample population mean was found to be 63 years with a standard deviation of 3.7 years. A Student t test of no difference between the sample population mean retirement age and 62 years of age was rejected at the five percent significance level. The data were found to be significant at the .001 alpha level, which almost completely dispelled any chance of a type I error having occurred. However, a similar test of no difference between the mean retirement age of AFLC Headquarters retirees and 62 years could not be rejected at the five percent level. This indicated that employees within the AFLC Headquarters can be expected to retire at a somewhat lower age than personnel of the 2750th Air Base Wing, as will be statistically proven later on in this paper.

Sex

For the sample population, male retirees were found to outnumber females by about three to one. Of the 484 retirees, 360 of them were men and 124 were women. The mean optional retirement age of men during the period of

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[1]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 27.

the study was found to be 62.6 years with a standard deviation of 3.7 years. In contrast, the mean retirement age of women was somewhat higher at 64.2 years with a substantially smaller standard deviation of only 1.9 years. This indicated that a woman who works until retirement age tends to stay on working to an older age than does the average male employee. Using the Mann-Whitney U test, a null hypothesis of no difference in the retirement age of the two groups was rejected at the five percent significance level. In fact, the results of the test indicated the data were significant to the .001 level.

Upon finding that women apparently retire at an older age than do men, the author began to search the available data to see if a logical reason could be found to support this phenomenon. Interestingly, it was found that only 26 percent of the female retirees were married. The author, of course, had no way of knowing what percentage of this group was comprised of "old maids" and what percentage represented widows and divorcees, but a reasonable conclusion would seem to be that unmarried women continue working on past the minimum retirement age because of the "companionship and security" provided by the work environment that they feel they would lose and not be able to recapture elsewhere if they quit working.

Another interesting statistic of the female retirees was that 11.3 percent of them retired from positions graded

at GS-11 or higher, with approximately half of this group being GS-12's. Although this percentage is comparatively low when one views the entire population, especially if one only looks within the AFLC Headquarters, it still came as a mild surprise to the author that 14 of the 124 women retirees did, in fact, hold relatively high graded positions. The female group as a whole was found to be almost universally classified act employees with grades ranging from GS-3 to GS-13.

Another interesting comparison between male and female retirees involved length of service. The total length of federal employment of men was found to average 28.2 years with a standard deviation of 5.1 years; women averaged only 24.5 years of federal service with a standard deviation of 5.3 years. The fact that the average man worked almost four years longer than did the average woman employee, yet retired an average of one and a half years younger, could have several different explanations, all of which are beyond the scope of this paper to explore.

Obviously, the average woman retiree went to work for the Government somewhat later in her life than did her male counterpart. Some may have lost their husbands in World War II, and not remarrying, found it necessary to go to work; many probably did not start a career until their children had entered school. Others may just have gotten caught up in the increasing wave of women leaving

the house to find careers in the business world. Whatever the reason may be, it can be concluded from the data collected in this research effort that women retirees in AFLC are somewhat older than men retirees, have less total service than do the men, and are far more often unmarried at the time of their retirement than are male employees.

Marital Status

The group under study was composed of 356 married employees and 128 who were unmarried. Classified by sex, the married group was made up of 90.5 percent males and only 9.5 percent females, whereas the unmarried group was composed of 72 percent females and only 28 percent males. The women dominated the unmarried group despite the fact that they made up only 25.6 percent of the sample population. This indicated that more men than women are successful in finding another mate after divorce or loss of spouse through death, or that there are far more spinsters in the world than never-married men.

The mean retirement age of married employees was found to be 62.6 years with a standard deviation of 3.6 years. Single retirees were found to be older on the average. Their mean retirement age was 64.1 years with a standard deviation of 3.7 years. The reader may have noted that these statistics are nearly identical to those presented for the male retirees when they were compared

to women. However, in light of the composition of the two groups previously presented, one might expect that such would be the case.

A Mann-Whitney U test of the null hypothesis that there was no difference between the retirement age of married and unmarried employees was rejected at the five percent level. The data was found to be significant to the .001 level, thus allowing the researcher to state with 99.9 percent confidence that married AFLC employees at Wright-Patterson AFB retire on the average at a younger age than do single employees.

A check of the data for those who had already established a retirement home away from the Dayton, Ohio area, at the time of filing their Application for Retirement, disclosed that one-third of them were unmarried. This figure, when compared to the percentage of single retirees in the sample population of 26.5 percent, suggests nothing of substance as to whether married or unmarried employees are more inclined to move away from the Dayton area to establish their home of retirement.

Classification

Is there a difference in the retirement patterns of AFLC blue-collar and white-collar workers? This is a question the research effort attempted to answer by comparing the average retirement age of the two groups at Wright-Patterson AFB. The sample population contained

295 classified act employees and 189 wageboard employees. The mean retirement age of the wageboard workers was 63.7 years with a standard deviation of 3.2 years. GS employees averaged only 62.5 years of age at the date of their retirements. However, the standard deviation of the mean of the latter group was greater at 3.9 years.

Using the Mann-Whitney U test, the researcher rejected a null hypothesis of no difference between the mean retirement age of wageboard and classified act employees at the five percent significance level. The results of the test were found to be significant at the .001 level, thereby decreasing the chance of a type I error having been made. The author was able to conclude from the test that there was, in fact, a significant difference in the means of the two groups tested, i.e. that GS employees within AFLC can be expected to retire slightly before their wageboard counterparts.

Grade

The grade variable took on added importance in this particular study because of its direct correlation (assumed) to salary and the absence of actual salary data availability to the study. The researcher was particularly interested in the retirement behavior of employees filling the higher GS grades, because of the abnormally high grade structure within the AFLC Headquarters and the corresponding peculiarities involved in filling higher graded positions.

The classified act employees were arbitrarily separated into two groups, those occupying grades of GS-12 or higher at the time of their retirements, and those occupying grades of GS-11 and below. The mean age of retirement of the 118 employees graded GS-12 or above was found to be only 60.9 years of age with a standard deviation of 3.6 years. The 177 employees in grades GS-11 and below averaged 63.6 years of age at retirement with a standard deviation of 3.8 years. The almost three year difference in the mean of the two groups was statistically tested by applying the Mann-Whitney U test. A null hypothesis of no difference in the means of the two groups was rejected at the five percent level of significance. In fact, the data were found to be so significant that the probability of type I error having occurred was virtually non-existent.

Wageboard retirees were also arbitrarily separated into two groups, those 32 employees occupying positions graded W-11, L-9, or F-6 and above, and the remaining 157 employees who filled supervisory or nonsupervisory positions of lesser grade. The mean age of retirement was 62.8 years with a standard deviation of 3.1 years for the higher graded grouping. This compared to a slightly higher average age of retirement for the lower graded group of 63.9 years. The standard deviation of the mean for this group was 3.2 years. Utilizing the Mann-Whitney U test

once again, the author found that a null hypothesis of no difference between the mean ages of retirement of the two groups could not be rejected at the five percent level. However, if one were willing to accept results significant to the ten percent alpha level, the difference could be shown to be statistically significant.

Interpreting the results of the two tests, the author was led to the conclusion that the higher graded GS and WB employees retire at an earlier age than do their lower graded counterparts. The difference within the GS ranks was found to be particularly significant. The salary relationship cited earlier is of interest, as the higher rated WB group was arbitrarily set at a level where everyone would be earning an annual salary of at least $10,000. Likewise, the higher graded GS group could be expected to have been earning more than the $10,000 per year figure at the time of their retirements.

From the test results, one could also conclude that higher salaried AFLC employees retire earlier than do those with less earning power. This finding is exactly the opposite of an earlier referenced study conducted by the Social Security Administration where it was found that those with high earning capacity were less inclined to retire than those with lower earning capacity. This was explained by the author, Lowell Gallaway, to be a result of the old-age, survivors, and disability insurance program (OASDI)

replacing a greater percentage of the earnings of the lower salaried group, thereby making retirement more attractive to them than to those used to having higher annual incomes.[1]

The difference in the findings of the two studies would appear to be due to the difference in the two retirement programs, i.e. OASDI and civil service retirement. Where OASDI has a relatively low maximum benefit, regardless of prior earning capacity, the civil service retirement plan rewards high income groups on a completely pro rata basis, i.e. annuities are based on a percentage of the high three years average salary with the only determining factor for that percentage (maximum of 80% allowed) being total length of creditable federal service.[2] Thus, retirement would appear to be more attractive to higher income civil service families as their expected annuity will better provide for some of the so-called "luxuries of life", in addition to the bare necessities which the OASDI and lower income civil service families would expect to have provided by their retirement incomes.

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[1]Gallaway, Lowell E. The Retirement Decision: An Exploratory Essay. Social Security Administration Research Report No. 9, U.S. Department of Health, Education, and Welfare, June 1965.

[2]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 47.

Health

Earlier in this paper it was hypothesized that the mean retirement age of those retiring because of poor health or disability reasons would be lower than those who did not claim poor health as a reason for retiring. Surprisingly, at least until one reconsiders the ramifications of the situation, this was not the case. For those 147 AFLC employees who chose optional retirement because of poor health, or otherwise were incapacitated for duty (the only advantage over regular optional retirement is that it enables the employee to take his accumulated sick leave prior to his retirement becoming effective[1]), the mean retirement age was found to be 63.7 years with a standard deviation of 3.4 years. Those not claiming poor health retired at an average age of 62.7 years, a full year younger than the previous group. The standard deviation of the mean retirement age of the 337 employees in the latter group was 3.8 years.

Testing the difference noted between the two groups by means of the Mann-Whitney U test, a null hypothesis of no difference in the mean retirement ages was rejected at the five percent level. The data were also found to be significant at an alpha level of .001, which indicated there was little chance of a type I error having occurred.

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[1]"Civil Service Retirement: Disability Versus Optional Retirement," United States Civil Service Commission Bulletin No. 831-30, Washington, D.C., 28 July 1970.

Upon finding that the researcher's original hypothesis was the exact opposite of the actual situation, i.e. that those retiring for medical reasons were in fact older than those who apparently retired for other reasons, the author began to look at things with a completely new perspective. The situation even began to make sense. Those who are more or less "forced" into retirement because of poor health are for the most part people, who when first reaching retirement age, decided to continue working as opposed to optional retirement. Therefore, it would seem logical to assume that if the group did not contain any of those who chose to retire at their earliest opportunity, as the study showed that many do, the average age of retirement would, in fact, be somewhat higher. Thus, the "involuntary" nature of their retirements supports the finding that those forced into retirement because of their failing health tend to be somewhat older than those in good health who "voluntarily" elect to retire.

Organization

Because of perceived differences in make-up, whether real or imaginary, of the two groups from which the sample came (i.e., higher grade structure in AFLC Headquarters, greater percentage of wageboard employees in the 2750th Air Base Wing, etc.), the author determined to see if there was a difference in the average age in retirement of AFLC Headquarters personnel and employees of the 2750th

ABW. A significant difference, if there were one, could adversely affect the applicability and subsequent use of any model developed from the entire sample population for predicting retirements within either of the two organizations under study.

Using the Mann-Whitney U test, a null hypothesis of no difference in the mean retirement age of the two organizations was tested at the .05 alpha level. It was found that the null hypothesis could be rejected at that level, as well as the far more powerful level of .001. The mean age of optional retirement for employees of the AFLC Headquarters was found to be 61.6 years with a standard deviation of 4 years. Employees of the 2750th ABW retired on the average at 63.6 years of age with a standard deviation of 3.4 years. Thus, it has been shown that there is a significant difference, two years, in the average retirement age of AFLC Headquarters and 2750th ABW personnel. This holds true whether one wishes to look at it from a purely statistical viewpoint or from a more empirical one. At this point, it became perfectly clear to the author that the model building to be done in Chapter 4 of this paper must try to account for the differences in make-up of the two organizations. The predictive models constructed should be the best possible from the available data if they are to be of maximum benefit to those who may use them.

Military Retirement Pay

Primarily because of the availability of data, the researcher determined to ascertain if the fact that a civilian employee was a military retiree, either from the active forces or from a reserve unit, had an effect on the age at which he retired. One could intuitively make a case for both an earlier retirement and one beyond the average, depending upon how one viewed the fact that the employee was drawing double compensation in the form of his military retirement pay and his regular civil service salary. However, the data collected indicated that the average retirement age of those receiving military retirement benefits was only slightly less than that of the remainder of the sample population.

The mean retirement age of those civilian employees receiving military retired pay (16 of the 24 were retirees from active duty; the others had retired from reserve units) was found to be 62.1 years with a standard deviation of 3.5 years. This compared to the population average age of retirement of 63 years with a standard deviation of 3.7 years. Testing the difference between the two means via the Mann-Whitney U test, the researcher found that a null hypothesis of no difference between the two could not be rejected at the five percent significance level. The results would only have been significant at an alpha level of .20 or greater. The small sample size

of the military retiree group undoubtedly had a good deal to do with the results of the test not being significant. However, based upon the limited data available, one must conclude that the receipt of military retirement pay does not significantly affect civilian retirement ages.

Home of Retirement

The researcher had hypothesized that the retirement age of those retiring to homes away from the Dayton, Ohio area would on the average be lower than the ages of those retiring in Ohio. Unfortunately, the only information source available to the researcher was Standard Forms 2801, Application for Retirement, which would normally be completed prior to the applicant's changing his address, even if he did plan to move away from the Dayton area upon his retirement. Therefore, the data analysis performed by the researcher can be described as questionable, at best, as many of those listing Ohio addresses on their Application for Retirement may have retired to homes outside of Ohio.

A total of 39 of the 484 retirees did list an out-of-state address at the time of applying for retirement. The mean retirement age of this small group was found to be 62.7 years with a standard deviation of 3.3 years. This compared to the population mean of 63 years and its standard deviation of 3.7 years. A Mann-Whitney U test of a null hypothesis of no difference between the

retirement ages could not be rejected at the five percent level. Only if one were willing to accept data significant to a level of .46 could the null hypothesis have been rejected. However, much of the power of the test was lost by the one group, out-of-state retirees, being so small in comparison to the group that had to be considered as not retiring to out-of-state homes.

One must wonder, had better information been available, if there was actually a significant difference in the retirement ages of those staying in Ohio and those migrating to "greener pastures". Admittedly, the test performed by the author was accomplished more from a standpoint of what he would have liked to have had, i.e. complete information as to final home of retirement for all retirees studied, than from what he actually hoped to accomplish with the limited data available. However, the difference noted between the mean retirement ages of the 39 who were definitely "out-of-state retirees" and that of the population was far less than was expected by the author.

Age of Spouse

The mean age of the spouses of the 356 married retirees was found to be 58.7 years with a rather large standard deviation of 6.1 years. These figures, when compared to the married retirees' average age of 62.6 years and standard deviation of the mean of 3.6 years,

reflect a difference of approximately four years difference between the retirees' ages and the ages of spouses.

The author had hypothesized that age of spouse should directly correlate to an employee's age of retirement, on the premise that those younger retirees would, on the average, have younger spouses than the older retirees, and vice versa. A Spearman Rank Correlation Coefficient test was used to test a null hypothesis stating the coefficient of correlation (r) was equal to zero when age of retirement was compared to age of spouse. The r value obtained was 0.41 which, when converted to a t statistic, had a value of 8.34 with 354 degrees of statistical freedom. This permitted the null hypothesis to be rejected at the five percent significance level via the Student t distribution. The data were also found to be significant at a level of .001 and considerably beyond. Therefore, one can safely conclude that there is, in fact, a direct correlation between age of spouse and the age of retirement of married AFLC employees.

Retirement
Eligibility

AFLC civilian retirees (optional) at Wright-Patterson AFB were found to have been eligible for retirement, on the average, a period of 3.33 years with a standard deviation of 2.6 years, before electing to exercise their retirement options. This closely paralleled a somewhat

similar study conducted at the Ogden Air Materiel Area where it was found that OOAMA employees nearing retirement planned to work an average of three years beyond the first date they would become eligible for retirement.[1] Eligibility for retirement in this study ranged from numerous retirements occurring at the very first opportunity to retire without a reduction in annuity to an individual high of 12 years service after becoming eligible for optional retirement.

Table 1 reflects the mean number of years eligible to retire broken out by length of service corresponding to the various thresholds of retirement eligibility at ages 55, 60, and 62.[2] Although it appeared that those in the 30 years of service category were slightly less inclined to continue working after becoming eligible for retirement, the data indicated no really significant differences between any of the three groups. Thus, the study indicated that length of service has little bearing on the retirement decision once an individual has actually become eligible for retirement: this despite the fact that civil service retirement annuities are graduated on

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[1] "Retirement Eligibility and Projections." An unpublished set of charts developed as a part of Project HIPRO, Hill AFB, Utah, 1968.

[2] Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 27.

a percentage basis corresponding directly to length of service.[1]

Table 1

Mean Number of Years AFLC Employees Sampled Were Eligible for Retirement When Classed According to Length of Service

Group	Total Number	Mean	Range Low	Range High
Over 30	147	2.83	0	12
Over 20	290	3.53	0	9
5-20	47	3.61	0	8

Source: Sample population data cited in study.

The author had hypothesized that length of retirement eligibility would be directly correlated to age of retirement. The hypothesis was based upon the rationality that the longer one goes without exercising his retirement option once he is eligible to retire, the older he becomes. Thus, a direct relationship should occur between the two variates.

A Spearman Rank Correlation Coefficient test was performed on the null hypothesis stating no difference between the correlation coefficient (r) and zero. The null

[1]Ibid., p. 45.

hypothesis was rejected at the .05 level and was so significant that it could have been rejected at almost any desired alpha level. The r value of 0.86 indicated an extremely fine direct correlation existed between the number of years eligible to retire and the age of retirement. The actual value of retirement eligibility as a predictor of retirement age was subsequently proved by the author in a later chapter of this research paper.

Length of Service

One of the hypotheses of this research paper was that the total years creditable federal service of an employee could be used to predict the age at which he could be expected to retire. This hypothesis was based upon the premise that "length of service" was correlated to age of retirement. The author expected the correlation, if any, between length of service and retirement age to be of an inverse nature because of civil service retirement laws allowing one to retire at age 55 with 30 years creditable service and at age 60 with 20 years service. This compares to a retirement age of 62 or greater for those having less than 20 years total federal service, with the exact age of eligibility depending upon whether or not the employee has a total of 5 years creditable civilian service accumulated.[1]

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[1]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 27.

The Spearman Rank Correlation Coefficient test was used to determine if, in fact, a correlation did exist between length of service and age of optional retirement. A null hypothesis stating the coefficient of correlation (r) was equal to zero was tested at the five percent level of significance. An r of -0.42 was obtained and converted to a t statistic of -10.14 with 482 degrees of freedom. Testing this value with the Student t distribution tables, the researcher found that the null hypothesis could be rejected, even at the .001 and greater levels of significance. The negative r value indicated that the relationship between length of service and age of retirement was, in fact, an inverse one, i.e. age of retirement decreases with increasing service.

The author noted in working with the data that this relationship normally held true up until an employee had accumulated about 30 to 32 years of service, at which time he would have reached 55 years of age. If he did not choose to retire at the 55 year mark, the relationship no longer held, as his age of retirement necessarily must then increase with additional service. Therefore, as with most predictors or mathematical relationships, there was found to be a limit or range to its applicability, i.e. around 30 to 32 years length of service, or at that point where a potential retiree first becomes eligible to retire. From that point on until retirement, his additional length

of service cannot possibly be inversely proportional to his age at retirement.

For all employees in the sample population, the average years of federal service, including both civilian and military service, was found to be 27.3 years with a standard deviation of 5.4 years. The range was 11 years to a whopping 50 years of total service. The mean length of service for the 360 men in the sample was 28.2 years, which compared to an average length of service for women retirees of only 24.5 years. This was discussed at greater length in a previous section of the paper.

Cost of Living Adjustments

Whenever the cost of living, as shown by the Consumer Price Index, goes up by a full three percent over the month used as the base for the last increase, and holds there for three consecutive months, an increase equal to the percentage rise in the cost of living index is automatically granted to the annuities of civil service retirees. Another one percent is then added to this amount because of the time lag involved in getting the increase to the annuitants. The increase does not become effective until the first day of the third month after the price index has held the three percent increase for three full

months. The increase applies only to those annuitants who have retired on or before the date it becomes effective.[1]

Because of the latter mentioned stipulation, the researcher anticipated that a great number of AFLC civilian employees would elect to exercise their retirement options before the effective date of every cost of living increase. The data collected strongly supported this contention. In the one month periods preceding COLA increases on 1 May 1968, 1 March 1969, 1 November 1969, and 1 August 1970,[2] there were respectively 48, 44, 73 and 51 optional civilian retirements within the AFLC Headquarters and the 2750th ABW. In comparison, the average number of monthly retirements for the three year period under study was only 13.4.

A null hypothesis which stated that the number of retirements decreases or remains the same during periods when cost of living increases are applicable was rejected at the five percent level of significance. The Student t test was used to perform the analysis. Data were found to be significant to the .005 level which indicates there was little likelihood of type I error.

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[1]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 49.

[2]Wright-Patterson AFB, Ohio. Personal interview with Mrs. Mary McCarty, 2750th Air Base Wing Civilian Personnel Branch, Wright-Patterson AFB, Ohio. 26 February 1971.

Although the magnitude of this finding is "old hat" to those familiar with civilian personnel retirement patterns, it does have considerable value when looking at retirements from a standpoint of prediction. As one can readily determine from looking at Figure 1, the cost of living index rose from 5 to 6 percent during each of the years from 1967 to 1970.[1] Knowing that such an increase is likely to continue, personnel managers should be able to determine approximately when the next COLA adjustment could be expected to occur and adjust their retirement predictions accordingly. Of particular importance would be a determination of whether or not two cost of living increases could be expected to occur in a single fiscal year. Armed with this and other pertinent information, and a general feel for the approximate months COLA's could be expected to become effective, an AFLC personnel manager should have a much better handle on the attrition rate that he could expect to encounter during a given year.

Negating almost entirely the influence of COLA's upon the "bunching" or "massing" of retirements would be the passage of Senate bill 1681, or a similar measure, which would enable civil service employees retiring after

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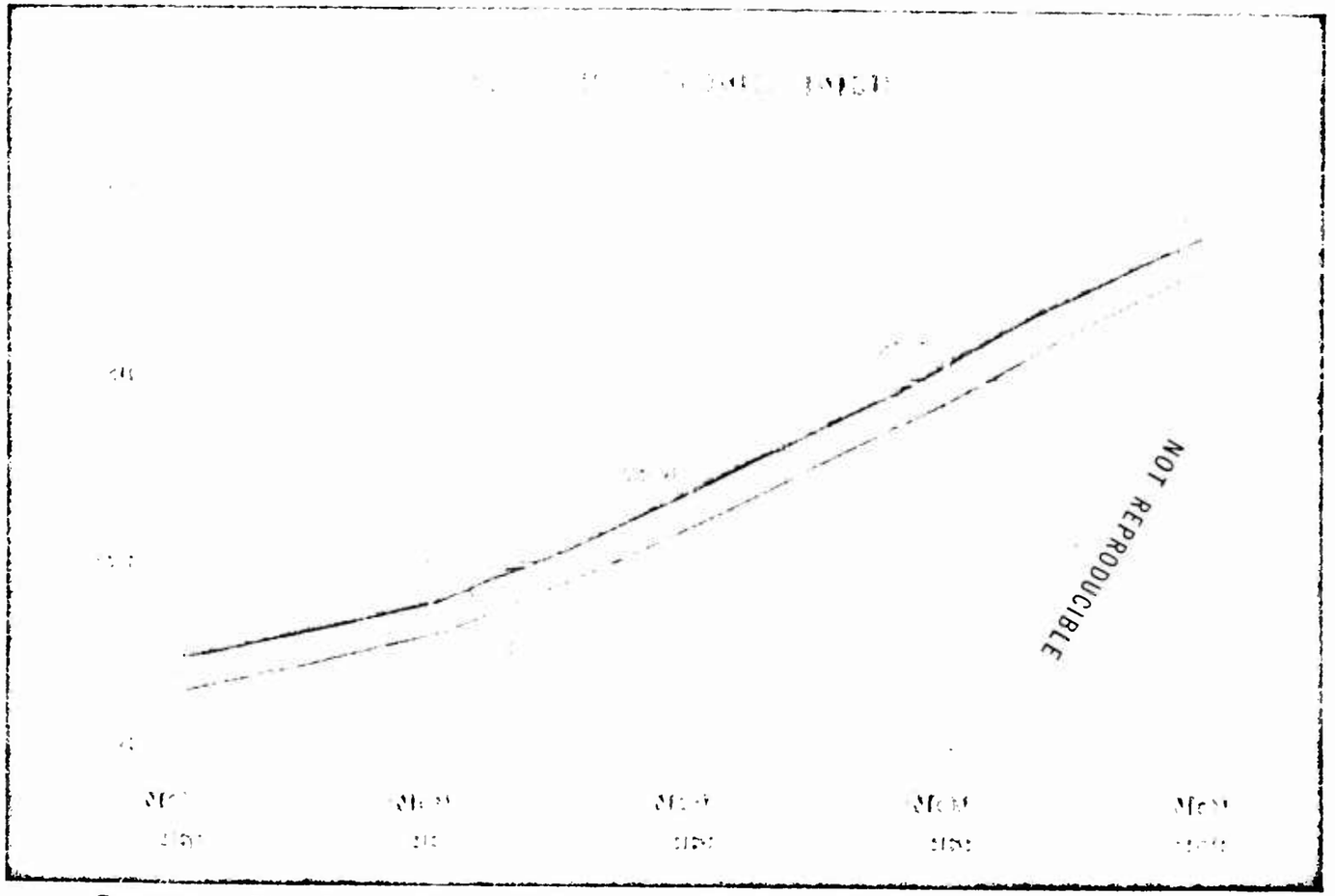
[1] The Government Standard. American Federation of Government Employees, Washington, D.C., 11 June 1971.



Source: The Government Standard. 11 June 1971, p. 12.

Figure 1

COST OF LIVING INDEX FOR SELECTED YEARS 1966-1970

the effective date of a COLA to also qualify for the increase. Although backed by the Administration, the passage of S-1681 appeared somewhat dubious at the time this paper was written because of an amendment tacked on by the House calling for the Postal Service to make annual payments to the Civil Service Retirement Fund covering retirement costs raised by future postal pay raises.[1] However, until such a law is passed, if ever, the cost of living increase will continue to be a very important determining factor in the decision to retire.

Other Factors

There are many factors, other than those investigated in this study, which could weigh heavily upon one's decision to retire. Some of these that the researcher would liked to have investigated, but did not have the data available to him, included: (1) time in grade, (2) rate of career progression, (3) career satisfaction, (4) morale, (5) financial status, (6) number of dependents supported, (7) home ownership, (8) business interests, (9) special job qualifications, (10) attitude toward retirement, and (11) length of time lived in the Dayton, Ohio area. Certainly, no study of retirement, or any model developed

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[1] "Senate Expected to Reject C-O-L Bill," The Government Standard. American Federation of Government Employees, Washington, D.C. 28 May 1971.

for the purpose of predicting retirements, could be called complete without investigating all of the factors cited and any others which might come to mind. However, a great deal can usually be learned about something without closure having occurred. When, in real life situations, do we ever have complete information about anything? Most assuredly, the author would have liked much more complete information than was available; however, in the majority of cases, one has to make do with the best information available, which oftentimes provides quite satisfactory results.

Summary

The author has presented facts, findings, conclusions, and opinions about factors which may or may not affect the decision of AFLC employees to retire. It was shown that sex, marital status, employee classification, grade, organization, state of health, and COLA applicability all significantly affected the age of retirement. Age of spouse and length of time eligible for retirement were found to be directly correlated to retirement age; length of service was inversely correlated to age of retirement. Those factors that were not found to significantly affect the age of retirement included military retirement status and home at the time of applying for retirement.

It was found that employees of the AFLC Headquarters could not be expected to retire at the same age as employees of the 2750th ABW. Men retire younger than do women, and married AFLC employees retire earlier than their unmarried peers. High graded employees, especially in the GS ranks, retire at a considerably younger age than do lower graded workers. Taking these and other considerations into account, the author has attempted in Chapter 4 to build a predictive retirement model capable of adequately predicting the retirement ages of, not only those in the sample population of the study, but of those civilian employees in the current AFLC workforce.

Chapter 4

DEVELOPMENT OF A PREDICTIVE RETIREMENT MODEL

Overview

The second and primary objective of this research effort was to construct a quantitative model for predicting, with a high degree of accuracy, the occurrence of optional retirements of AFLC civilian employees. In this chapter, the author takes those variable factors determined in the preceding chapter to be correlated to age of retirement and develops a multiple regression model capable of accurately predicting the age of retirement of AFLC civilian employees. A general model applicable to all AFLC employees was developed, as were other more specialized models applying only to segments of the AFLC civilian workforce. Finally, the use of the model in predicting the number of optional civilian retirements to be expected in any given year, or longer time frame, is fully explained.

Development of the Model

The detailed methodology followed by the author in developing the model was presented in Chapter 2 of this paper. This section of the paper discusses the results

of applying that methodology and provides the reader a good deal of insight into the author's logic in developing the regression model.

Curve Fit Analysis

Using the GE-600 CURFIT computer program previously referenced,[1] the author determined the shape of the curve which would best describe the functional relationship between the proposed predictors, age of spouse, number of years eligible for retirement, and length of federal service; and that which was to be predicted, age of retirement. An arbitrarily chosen random sample of 75 retirees from the sample population utilized throughout the study was used in the curve fit analysis.

The best prospective predictor, of the three variables analyzed, appeared to be length of retirement eligibility. Of the six different types of curves the researcher attempted to fit to the data, a linear relationship, $Y = a + bX$, was found to give the best results, i.e. that regression line having the highest index of determination (r^2) and thereby containing less unexplained variation than did the other regression lines fit to the data points. Length of retirement eligibility, as indicated by the results obtained from the CURFIT program

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[1] GE-600 Line Time-Sharing Programs. Technical Manual CPB-1694. The General Electric Co., July 1970.

(r^2 of 0.76), appeared to be an excellent predictor of retirement age.

A curve fit analysis performed on length of service as a predictor of retirement age also yielded fairly satisfactory results, although the index of determination corresponding to the best of the curves fit to the data was not nearly as good (0.29) as that obtained when retirement eligibility was tested as a predictor. The highest coefficient of determination (r^2) for length of service was attained with a hyperbolic function, $Y = a + b/X$. However, since the r^2 obtained with the hyperbolic functional relationship was only .007 greater than the r^2 associated with the linear curve, the author decided in favor of the linear relationship because of its simplicity and more general usage in regression analyses.

Age of spouse, when tested in the CURFIT program, did not appear to be of much value as a predictor of age of retirement. A "best" index of determination of 0.11 was obtained for the regression line when using the hyperbolic function, $Y = 1/a+bX$. This compared to an r^2 of 0.09 for the linear regression line constructed. The author decided to use the linear relationship in any further regression analyses in which age of spouse might be tried as a variate because of its being easier to work with and because the linear relationship had previously been selected for the other potential predictors under study.

Multiple Regression Analysis

Regression analysis is a means of explaining cause-and-effect or functional relationships between two or more variables. By constructing simple or multiple regression lines, one may predict the value of one variable on the condition that the value(s) of one or more other variables are known. Variables used as the basis of estimation are conventionally called the independent variables and are designated by X; the variable whose value is to be estimated is called the dependent variable and is designated Y. When an equation is formulated for estimating the value of Y from given values of X, such an equation is called a regression of Y on X.

The regression analysis technique is nothing more than a procedure of estimation or prediction. Regression analysis is classified as simple regression when only two variables are involved and multiple regression when three or more variables are involved, one of which is the dependent (Y) variable that is to be estimated on the basis of the values of all the others.[1]

Simple or multiple linear regression lines can be calculated by the method of least squares, whereby the variation of Y values about the regression line are

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[1]Chao, Lincoln L. Statistics: Methods and Analyses. McGraw-Hill, New York, New York. 1969. pp. 325-6.

minimized with respect to the X data points used to predict Y. The standard error of the estimate of Y is calculated to provide a measure of the sum of the squared deviations of Y from the sample mean $\bar{Y}$. The difference between individual Y values and $\bar{Y}$ when no regression line has been fit to the data is referred to as "total variation". The amount of error removed by fitting a regression line to the data is termed "explained variation"; that amount of error that still remains after fitting an appropriate regression line is referred to as "unexplained variation".

The coefficient of determination (r^2) of the regression model is a measure of the goodness of the regression line fit to the data points. The value of r^2 is determined by dividing the sum of the squares of the explained variation by the sum of the squares of the total variation of Y, given the regression of Y on X. The numerator of r^2 represents that amount of variation explained by the regression line, and the ratio itself then is the proportion of total variation accounted for by linear regression. Thus, the higher the value of r^2 and the lower the value of the standard error of the estimate, the better will be the predictive accuracy of the regression model developed.[1]

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[1]For a complete discussion of multiple linear regression, the interested reader should refer to Regression Analysis by E.J. Williams, D. Sc. Wiley Publications in Statistics, New York, New York. 1959.

The actual model construction was begun by taking the most promising looking predictor of retirement age, length of retirement eligibility, as determined by correlation and curve fit analysis, and incorporating it into a linear regression model as the X variable. The Y variate, that which was to be predicted, was age of retirement, as it was in all of the researcher's subsequent model building exercises. In the development of a general predictive retirement model, the author used all 484 of the sample population data points.

Using a computerized matrix solution for the general linear regression model,[1] $Y = b_0 + b_1X$, a rather good model, with a coefficient of determination (r^2) of 0.71, was achieved by using length of retirement eligibility as a predictor of retirement age. The model, $Y = 58.98 + 1.20X$ (estimated age of retirement = 58.98 years + 1.20 years eligibility for retirement), had a standard error of the estimate of 2 years. The standard error of the regression coefficients b_0 and b_1 was 0.15 and 0.04, respectively. The overall goodness of the predictive model was tested by the F distribution test of overall regression coefficients. A null hypothesis stating the slope of the regression line was equal to zero could be

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[1] James, Francis E., Jr., Lt. Colonel, USAF, Ph.D. A Matrix Solution for the General Linear Regression Model. Technical Report No. 4. Air University, Air Force Institute of Technology, School of Systems and Logistics, Wright-Patterson AFB, Ohio, May 1969.

rejected at the .001 level of significance, as it could for all subsequent models developed in this research effort. Thus, the usefulness of this and subsequent models as a predictor of retirement age was found to be statistically sound.

The next step in the construction of a general retirement model based on all the sample data points was to add a second variate, length of service, to length of retirement eligibility in the formulation of a multiple linear regression model. The model formulated turned out to be a very good one having an r^2 value of 0.90. The model, $Y = 67.07 - 0.30X_1 + 1.23X_2$ (estimated age of retirement = 67.07 years - 0.30 years federal service + 1.23 years eligibility for retirement), had a standard error of the estimate of 1.2 years. The standard error of the net regression coefficients b_0, b_1, and b_2 was 0.29, 0.01, and 0.02 respectively, which further indicated the presence of a very good predictive model.

The final effort in the search for a general predictive retirement model was to add the third of the hypothesized predictors, age of spouse, to those variables already included in the multiple regression model. In order for this particular variate to be used, the model had to be "trimmed down" to include only those 356 married retirees within the sample population. The model developed, $Y = 66.01 - 0.31X_1 + 1.22X_2 + 0.02X_3$ (estimated age of

retirement = 66.01 years - 0.31 years federal service + 1.23 years eligibility for retirement + 0.02 age of spouse), had an r^2 value of 0.89 and a standard error of the estimate of 1.22 years. Thus, one can readily see that the addition of a third variable, age of spouse, not only did not add anything to the effectiveness or usefulness of the model, but detracted slightly from that previously developed.

The General Model

In the previous section, it was found that the best multiple linear regression model that could be developed by the researcher, when using all of the 484 data points in the sample population, included length of federal service and length of retirement eligibility as predictors of a given AFLC civilian employee's age of retirement. This model, developed with the entire sample population of data points, will be referred to throughout the remainer of this paper as the general retirement model. The general model, as reflected in Table 2, is, in the author's opinion, capable of providing reasonably accurate projections of AFLC civilian optional retirements. The use of the model will be discussed in detail in a later section of this chapter.

Table 2

A General Model for Predicting Optional Retirement Age of AFLC Civilian Employees

Group	Applicable Model
All Civilian Employees	$Y = 67.07 - 0.30X_1 + 1.23X_2$

where,

Y = estimated age of retirement

X_1 = length of federal service in years

X_2 = length of retirement eligibility in years

Source: Application of the general linear regression model to sample population data cited in the study.

Specialized Forms of the Retirement Model

Having developed a satisfactory general retirement model, the author's next efforts were directed toward modifying the general model to fit different segments of the AFLC civilian workforce where it was shown previously in this paper that significant differences in retirement age existed. Unfortunately, due to lengthy computer breakdowns, the author was unable to accomplish all of his objectives in this respect. However, several good regression models were obtained for selected segments of the AFLC civilian workforce.

Table 3 reflects those modifications of the general retirement model which the author was able to develop before the final coup de grâce occurred with respect to further work on the GE-600 computer. Of particular interest to this study was the development of a model for predicting the losses through retirement of AFLC managers and high grade specialists. The development of such a model was given priority in this research effort because of the complexity of personnel management problems associated with the recruitment, placement, and training of AFLC managers in the higher graded GS positions.

A model developed from the retirement patterns of the 118 GS-12 and higher graded retirees in the sample population contained more variation and was not as good a model, overall, as the general model. However, since

the model was "tailored to fit" the higher graded GS employees, it should do a slightly better job of predicting future retirements than should the general model developed earlier. The model developed, $Y = 68.65 - 0.37X_1 + 1.38X_2$, had a multiple coefficient of determination (r^2) of 0.82 and a standard error of the estimate of 1.54 years.

On the other hand, when the higher graded employees (GS-12 and above) were left out of the sample population, a regression ran on the remaining wageboard and lower graded GS employees provided a slightly better model than the general retirement model. This model, $Y = 66.65 - 0.28X_1 + 1.20X_2$, had an r^2 of 0.91 and a standard error of the estimate of only 1.03 years. The standard error of the regression coefficients was 0.29, 0.01, and 0.02, respectively.

Other models were constructed to account for the significant difference in mean retirement ages (1.5 years) of those married and unmarried civilian employees in the AFLC workforce. A model developed from data pertaining to the 356 married employees in the sample population had an r^2 value of 0.89 and a standard error of the estimate of 1.23; thus, it was found to be slightly inferior to the general retirement model developed. However, if one were interested in predicting retirements for only the married employees, this model, $Y = 67.49 - 0.32X_1 + 1.24X_2$, should provide slightly more satisfactory results than the general model because of its "tailored to fit" nature.

Table 3

A Model for Predicting Optional Retirement Age of Designated Segments of the AFLC Civilian Workforce

Group	Applicable Model
High Grade GS	$Y = 68.65 - 0.37X_1 + 1.38X_2$
WB & Low Grade GS	$Y = 66.65 - 0.28X_1 + 1.20X_2$
Married	$Y = 67.49 - 0.32X_1 + 1.24X_2$
Single	$Y = 65.80 - 0.25X_1 + 1.23X_2$

where,

Y = estimated age of retirement

X_1 = length of federal service in years

X_2 = length of retirement eligibility in years

Source: Application of the general linear regression model to applicable segments of the sample population data cited in the study.

The model developed for retirements of single employees should also closely approximate the retirement age of the average female employee because of reasons discussed earlier in this paper. A very good correlation of multiple determination of 0.92 was obtained when the regression line equation, $Y = 65.80 - 0.25X_1 + 1.23X_2$, was fit to the 128 data points of the sample population. The standard error of the estimate for the model was 1.06 years. This and the other models previously discussed were tested against data from the sample population to determine how well they would actually perform in predicting individual retirement ages. The results of these tests were very encouraging to the author. Unfortunately, time and the limited scope of this research effort did not permit the author to test the model against the current AFLC workforce, or to apply it to an historical period of retirements other than that from which the sample population came, i.e. calendar years 1968, 1969, and 1970.

Use of the Model

To use the predictive retirement models developed in this chapter, the following steps should be followed:

1. Add to the value of the X variables, length of service and length of retirement eligibility, that length of time (e.g. 1 year, 5 years, etc.) over which retirements

are to be forecast. For those individuals whose length of optional retirement eligibility is still a negative number, exclude them from further consideration as being possible retirees during the period of interest.

2. Insert the augmented values of the X variables into the general retirement model, or one of the several derivative models, and compute the Y value to get the forecast age of retirement.

3. Add to the employee's current age that length of time over which retirements are being forecast. Compare this figure to forecasted age of retirement. If the employee's actual age will reach or exceed the forecasted retirement age in the period of interest, consider the individual as a projected retiree.

Strict adherence to the above algorithm, for the entire population of those nearing retirement age, should provide the forecaster with the expected number of retirements during the period of interest. However, the models in this research paper were developed to predict only optional retirements. Therefore, a percentage factor representing the average number of disability retirements, and to a very limited extent, mandatory retirements, will have to be developed by those making use of the model. The expected number of disability and mandatory retirements for the period of interest should then be subtracted from the number of optional retirements forecast. This

procedure is necessary because the model cannot distinguish between those who will retire as "optional retirees" and those who will retire as "disability and mandatory retirees". However, a note of caution should be interjected at this point. When developing a reduction factor to account for annual (or other designated period) disability retirements for use with the models of this study, one should only account for the possibility of disability retirements for those who have already met or will have met the minimum requirements for optional retirement.

To use the model to predict annual optional retirements over a number of years, one should first add one year to the X variables and proceed completely through the algorithm previously presented to find the number of expected retirees for the first year. This procedure should be followed for the second year with two years being added to the current X variables. The number of projected retirees for the second year would then have to be reduced by the number determined for the first year. This routine should then be repeated until the total number of years in the period of interest have been calculated.

A final word of caution in using the retirement model seems appropriate to the author at this time. The model should not be extended beyond its relevant range, i.e. all models were developed for civilian optional retirements ranging between 55 and 70 years of age and were based on

normal eligibility rules.[1] Only through experience in working with the model will all of its idiosyncrasies, as well as its maximum usefulness be determined. However, the author has sufficient reason to believe that the models developed in this chapter will provide AFLC civilian personnel managers a far more effective method for predicting optional retirements than has heretofore been available to them. Hopefully, those who have heretofore had a need for a model such as those developed in this study will accept the challenge now offered by the author--of taking the retirement models developed, working with them, and perfecting them to the point that the results will always be useful in personnel planning studies.

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[1]Federal Personnel Manual Supplement 831-1, Retirement, United States Civil Service Commission, 9 June 1970, p. 27.

Chapter 5

SUMMARY AND CONCLUSIONS

Summary

AFLC managers engaged in personnel planning functions have been in need of a model capable of predicting civilian retirements with a reasonably high degree of accuracy. The objectives of this study were to determine those variable factors having significant influence upon the retirement decision, and to make use of those factors in the construction of a predictive retirement model. A sample comprising all 484 of the civilian optional retirements occurring within the AFLC Headquarters and the 2750th Air Base Wing during calendar years 1968, 1969, and 1970 was the source of information for this research effort; data pertinent to the study was extracted from Standard Forms 2801, Application for Retirement, on file at the 2750th ABW Civilian Personnel Branch, Wright-Patterson AFB, Ohio. The results of investigating the personal characteristics of the sample population of retirees led the researcher to the conclusion that sex, marital status, employee classification, grade, employing organization, state of health, and COLA applicability were influencing factors in the decision to retire. Furthermore, it was found

that length of retirement eligibility and length of federal service, when combined in a multiple regression model, could predict quite accurately the age at which a given AFLC civilian employee could be expected to exercise his retirement option. Finally, the use of this model for predicting the expected number of optional retirements within a specified period of time was fully explained.

Conclusions

Aided by appropriate parametric and nonparametric statistical analyses, along with curve fit and regression analysis, the author was led to arrive at the following conclusions.

Hypotheses

1. The mean optional retirement age of AFLC civilian employees differs significantly from that age, 62 years, where nearly all employees will have become eligible for retirement.

This hypothesis was found to be true for the entire sample population which had a mean of 63 years, but not for the AFLC Headquarters where a mean age of retirement of only 61.6 years was found to be in evidence.

2. There is a significant difference in the average retirement age of AFLC civilian personnel with respect to sex, marital status, grade, and employee classification.

The results of the study supported this hypothesis. Men were found to retire an average of 1.6 years younger

than do women. Likewise, married employees retire an average of 1.5 years earlier than do their unmarried counterparts. The difference was not quite so great between wageboard and classified act employees; however, it indicated that white-collar workers retire at an average age of 1.2 years below that of blue-collar workers. The study indicated that GS-12 and higher graded classified act employees retire at an average age which is 2.7 years less than that of the lower graded GS employees. The same relationship was found to hold within the ranks of the blue-collar workforce, where the higher graded employees were 1.1 years younger at the time of retirement than were those in lower graded specialties.

3. AFLC personnel retiring because of failing health choose optional retirement at a mean age below that of employees in good health.

This hypothesis was definitely not true. In fact, it was found that the exact opposite phenomenon was very much in evidence. Those "involuntarily" retiring because of poor health were, on the average, a full year older than those not claiming poor health as the reason for retirement.

4. There is a significant difference in the average retirement age of AFLC Headquarters personnel and personnel of the 2750th Air Base Wing.

This hypothesis must be accepted. A difference of two full years in the mean retirement ages of the two

groups was noted, with AFLC Headquarters employees usually retiring at younger ages than personnel of the 2750th ABW.

5. Civilian employees receiving military retired pay do not retire at the same average age as those not receiving military retirement benefits.

This hypothesis was not statistically acceptable. However, it was noted that those receiving military retirement pay averaged retiring 0.9 years earlier in life than did the non-military retirees.

6. Personnel retiring to homes outside of the Dayton, Ohio area retire earlier than those making their retirement home in the Dayton area.

This hypothesis could not be accepted, as no substantial difference was found in the mean retirement ages of those already having out-of-state addresses established at the time of applying for retirement and those listing Ohio addresses at that time.

7. Age of spouse, the length of time eligible for retirement, and total years creditable federal service, both civilian and military, are correlated to the age of retirement.

The results of applying correlation analysis disclosed the above hypothesis to be true. The best correlation coefficient (0.86) was attained for the "length of retirement eligibility" variable. Also shown to be directly correlated to age of retirement was the "age of spouse" variable having a correlation coefficient (r) of 0.41. Length of federal service was found to be inversely correlated to retirement age as reflected by an r value of -0.42.

8. The number of retirements increases significantly during periods when increased cost of living allowances (COLA) are applicable.

The final researcher's hypothesis had to be accepted as being true. During the four monthly periods preceding COLA's, the mean number of optional retirements was 54. In comparison, the mean number of monthly retirements for the three year period covered by the study was only 13.4.

Predictive Models

Through curve fit and regression analysis, the author was able to develop several suitable models for predicting the occurrence of AFLC civilian optional retirements. The general retirement model developed took the form: $Y = 67.07 - 0.30X_1 + 1.23X_2$, where Y represented retirement age, X_1 was length of creditable federal service, and X_2 represented length of retirement eligibility. It was concluded that age of spouse, although correlated to the age of the retiree, contributed nothing to the betterment of the model developed.

Derivatives of the general retirement model were developed to better account for differences in retirement patterns between high grade, classified act (GS-12 and above) employees and wageboard and lower grade GS employees. Also, models to account for observed differences in the retirement patterns of married AFLC civilian employees and their unmarried counterparts were derived. Testing the models as actual predictive devices led the author

to the final conclusion of the study--that, given the proper tools, AFLC civilian optional retirements could be accurately projected.

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APPENDIX

APPENDIX

This section of the paper contains all data collected from Standard Forms 2801 and other sources. The data, as coded, was used extensively throughout the research effort, via computer manipulation, as the basis for hypotheses testing and model building. An explanation of the coding used, together with the location of specific data contained in the print-out, is presented below.

Card Column	Item
1-3	Data Card Number (1-484)
5	Organization Code (1 = AFLC HQ, 0 = 275 ABW)
7-8	Date of Birth (Month)
9-10	Date of Birth (Day)
11-12	Date of Birth (Year)
14	Marital Status Code (2 = Single, 1 = Married)
16-17	Spouse's Date of Birth (Month)
18-19	Spouse's Date of Birth (Day)
20-21	Spouse's Date of Birth (Year)
23-24	Date of Separation (Month)
25-26	Date of Separation (Day)
27-28	Date of Separation (Year)

Card Column	Item
30	Sex Code (1 = Female, 0 = Male)
32-33	Years of Civilian Service
35-36	Years of Military Service
38-39	Employee Classification Code (10 = GS, 20 = WB, 22 = WL, 24 = WS)
41-42	Grade
44	Military Retired Pay Code (1 = Receiving, 0 = Not Receiving)
46	Type Military Retirement Code (3 = Reserves, 2 = Active Forces, 0 = Not Applicable)
48	Health Code (1 = Retired for Medical Reasons, 0 = Did Not Retire for Medical Reasons)
50	COLA Code (1 = Applicable to Retirement Decision, 0 = Not Applicable)
54-55	Year of Retirement

PRINT-OUT OF CODED RESEARCH DATA

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  7 0  41014 1  6 415  1 370 0 31  0 24  5 0 0 0 0 0 70
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 98 0  726 5 2  0 0 0  731/0 0 29  0 10 12 0 0 0 0 1 70
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105 0 1215 7 1  42126  731/0 0 12 20 24  3 1 2 0 0 1 70
106 0  716 8 1  91815  721/0 0 19  2 10  9 0 0 0 0 1 70
107 0  512 8 1  62321  731/0 0 26  3 10  7 0 0 0 0 1 70
108 0 1015 5 1  42317  716/0 0 30  0 20  9 0 0 0 0 1 70
109 0  928 9 2  0 0 0  731/0 0 32  2 24  6 0 0 0 0 1 70
110 0  621 6 1  917 8  731/0 0 30  0 24  5 0 0 0 0 1 70
111 0 1214 5 1  815 9  7 4/0 0 39  0 20 10 0 0 0 0 1 70
112 0  5 4 1 2  0 0 0  731/0 0 29  0 10  9 0 0 0 0 1 70
113 1  119 9 1  71715  717/0 1 28  0 10  5 0 0 0 0 1 70
114 0  2 7 6 1  1 9 6  731/0 0 26  0 20  3 0 0 1 0 1 70
115 1  420 8 1  91513  7 9/0 0 30  0 10 12 0 0 1 0 1 70
116 0 1028 0 1  612 3  731/0 0 18  0 10 11 0 0 0 0 1 70
117 0  9 4 4 1 121010  716/0 0 27  0 20  9 0 0 0 0 1 70
118 1  129 8 1  2 710  731/0 0 29  0 10 13 0 0 0 0 1 70
119 0  2 2 6 2  0 0 0  731/0 1 28  0 10  3 0 0 0 0 1 70
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121 0  210 4 2  0 0 0  7117 0 24  0 20  2 0 0 0 0 1 70
122 0  4 914 1  02014  7317 0 34  0 10  9 0 0 0 0 1 70
123 0  614 5 2  0 0 0  7247 0 19  3 20  2 0 0 0 0 1 70
124 1  7 113 1 11 315  7317 0 27  4 10 14 0 0 0 0 1 70
125 0 1226 1 2  0 0 0  9 170 1 28  0 10  7 0 0 0 0 0 70
126 0 10 6 5 1 11 411  9147 0 29  0 20 10 0 0 0 0 0 70
127 0  822 8 1  819 7  8287 0 19  0 10  5 0 0 0 0 0 70
128 1  7 310 1  5 310 12317 0 30  0 10 12 0 0 0 0 0 70
129 0  21610 1  5 118 12237 0 29  0 10 11 0 0 1 0 0 70
130 0  9 7 8 1  712 7 10317 0 19  2 20  8 0 0 1 0 0 70
131 1  3 9 7 1  222 7 11137 0 26  0 10 14 0 0 1 0 0 70
132 1  823 9 2  0 0 0 12 270 0 31  0 10 12 0 0 1 0 0 70
133 0  42910 1  22519 12 870 0 24  6 10 12 0 0 0 1 0 70
134 0  11313 1  41215 10 970 0 27  4 10 11 0 0 0 0 0 70
135 0  7 712 1  1 1 0 12317 0 20 13 20  7 0 0 0 0 0 70
136 1 12 910 2  0 0 0 12317 1 28  0 10  6 0 0 0 1 0 70
137 1  91215 1  32415 12117 0 24  6 10 13 0 0 0 0 0 70
138 0  517 8 1  7 413 11137 0  9 20 10 12 1 2 1 0 0 70
139 0  5 1 1 1  917 0 11 470 0 16  0 20 10 0 0 1 0 0 70
140 1  2 9 1 2  0 0 0 12 670 1 12  0 10  3 0 0 0 0 0 70
141 0  4 8 7 1  2 224 10270 0 25  0 10  4 0 0 1 0 0 70
142 1  314 5 2  0 0 0 10157 1 29  0 10  9 0 0 0 1 0 70
143 0  6 7 6 1 102010 12317 0 35  0 20  9 0 0 0 0 0 70
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CARD COLUMNS
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144 1 102010 1  6 7 6 12317 1 26  0 10  6 0 0 0 0 0 70
145 0  818 8 2  0 0 0 11207 1 26  0 10  5 0 0 0 1 0 70
146 0  924 4 1  425 3 11237 0 23  4 26  9 0 0 1 0 0 70
147 1 1130 8 2  0 0 0 11307 1 13  2 10  4 0 0 0 0 0 70
148 0  41013 1  12212 11 770 0 25  6 20 10 0 0 0 0 0 70
149 1  32913 1  22516 11127 0 30  0 10 13 0 0 0 0 0 70
150 0 11 9 4 1  51014 10 770 0 28  0 20  8 0 0 1 0 0 70
151 0  8 4 5 1  5 119 12217 0 28  0 24 12 0 0 1 0 0 70
152 0  824 4 1  21711 12147 0 28  0 20 10 0 0 1 0 0 70
153 0  822 2 1 101923 12247 0 29  0 20 10 0 0 1 1 0 70
154 0  8 610 1  51023 10 770 0 29  0 20  5 0 0 1 0 0 70
155 0  2 8 3 1  11522 10307 0 30  0 24 10 0 0 0 0 0 70
156 1  3 110 1 1018 9 12277 0 26  2 10 13 0 0 1 0 0 70
157 0 1226 2 1  614 7 10317 1 29  0 10  7 0 0 0 0 0 70
158 0  32010 1  8 513 12247 0 22  0 20  2 0 0 1 0 0 70
159 0  912 2 1  2 7 4 11 270 0 19  0 20 10 0 0 1 0 0 70
160 0  224 7 1  6 2 3 11307 1 17  0 10  4 0 0 0 0 0 70
161 0  1 9 5 2  0 0 0 12 370 1 26  0 10  6 0 0 1 0 0 70
162 1  11012 1 102218  21569 0 32  5 10 15 0 0 0 0 1 69
163 1  523 6 1 111925  1 469 0 24  1 10 12 0 0 0 0 0 69
164 0 1120 3 2  0 0 0  22869 1 27  0 10  7 0 0 0 0 1 69
165 0  3 2 5 1  6 9 9  22869 0 25  0 20 10 0 0 0 0 1 69
166 0  829 7 1  41027  22569 0 27  6 20  8 0 0 0 0 1 69
167 1  830 7 2  0 0 0  22869 0 21  4 10 12 0 0 0 0 1 69
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12345678901234567890123456789012345678901234567890123456789

168 0  331 4 1 1026 5  22869 0 26  0 24  6 0 0 0 0 1 69

169 1  9 2 9 1 1029 8  22869 0 24 14 10 12 0 0 0 0 1 69

170 0  820 7 1 1110 5  22869 0 34  0 10 12 0 0 0 0 1 69

171 0  814 8 1 10 212  22869 0 26  0 20  9 0 0 1 0 1 69

172 1  82713 1 111013  22869 0 29  2 10 11 0 0 0 0 1 69

173 0 111131 1  4 718  22869 0 26  3 20  7 0 0 0 0 1 69

174 0  211 8 1  911 6  1 469 0 24  0 10 12 0 0 0 0 0 69

175 0 12 2 6 1  7 213  1 469 0 27  0 20  8 0 0 0 0 0 69

176 0  515 5 1 1023 5  22869 0 26  0 20  1 0 0 0 0 1 69

177 0 1122 0 1  6 298  1 869 0 26  0 10 11 0 0 0 0 0 69

178 0 1224 7 1 11 2 2  11369 1 22  0 10  4 0 0 0 0 0 69

179 0  112 7 1  71910  11469 0 23  2 10  9 0 0 0 0 0 69

180 1  1 4 6 2  0 0 0  22869 1 26  0 10  3 0 0 0 0 1 69

181 0  429 3 2  0 0 0  22869 0 23  0 20  3 0 0 0 0 1 69

182 0  1 3 5 1  91213  21569 0 28  0 20 10 0 0 1 0 1 69

183 0  8 9 5 1  72015  22869 0 27  0 20  2 0 0 0 0 1 69

184 1  9 1 5 1 102315  1 469 0 33  0 10 15 0 0 0 0 0 69

185 0  51613 1  21613  22869 0 14 19 10  9 1 2 1 0 1 69

186 0 10 2 3 2  0 0 0  13169 1 21  0 10  7 0 0 0 0 0 69

187 1 1129 4 2  0 0 0  22869 1 22  0 10  5 0 0 1 0 1 69

188 1  612 1 1  730 6  22869 0 22  0 10 14 0 0 0 0 1 69

189 0 1017 4 2  0 0 0  22869 1 26  0 10  9 0 0 1 0 1 69

190 0  923 8 1  52217  22869 0 13 24 20  8 1 2 0 0 1 69

191 1 1018 8 1  7 810  1 369 0 26  0 10 12 0 0 0 0 0 69
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CARD COLUMNS
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192 0  320 6 1  01596  11709 1 17  0 10  5 0 0 0 0 0 69

193 0  331 5 1 12 5 3  22809 0 23  3 10 14 0 0 0 0 1 69

194 1  910 6 1  822 2  22809 0 27  0 10 12 0 0 0 0 1 69

195 0 121799 2  0 0 0  22809 1 26  0 10  4 0 0 1 0 1 69

196 0  721 3 2  0 0 0  22809 0 20  0 10  7 0 0 0 0 1 69

197 0 1016 3 1  8 9 7  2 009 0 26  0 20  8 0 0 1 0 1 69

198 0  926 3 1 101612  22809 0  9  3 20 10 0 0 0 0 1 69

199 1  3 3 8 1  222 7  22809 0 29  0 10 11 0 0 0 0 1 69

200 1  32512 1 11 616  22809 0 38  0 10 13 0 0 0 0 1 69

201 1 101599 1  510 7  1 369 0 27  1 10 13 0 9 0 0 0 69

202 1  9 3 6 2  0 0 0  22809 1 32  0 10 11 0 0 0 1 1 69

203 1  6 813 1  53013  21409 0 31  0 10 13 0 0 0 1 1 69

204 0 10 3 7 1 10 4 4  22809 0 16  0 20 11 0 0 1 0 1 69

205 1 113012 1  31115  22809 0 36  0 10 13 0 0 0 0 1 69

206 0  529 6 1 102215  11309 0 24  0 20 10 0 0 0 0 0 69

207 0  82312 2  0 0 0  22809 0 10 22 10 11 1 2 0 0 1 69

208 0  82110 2  0 0 0  22809 1 31  0 10  9 0 0 0 0 1 69

209 0 1230 1 1 1021 4  1 109 0 26  0 24  7 0 0 0 0 0 69

210 1  31914 1  01220  32109 0 26  4 10 12 0 0 0 0 0 69

211 1  4 9 3 1 12 6 2  1 209 1 20  0 10  4 0 0 1 0 0 69

212 0  9 511 1  3 6 6  22809 1 30  0 10  5 0 0 0 0 1 69

213 0  3 8 4 2  0 0 0  22809 1 27  0 10 11 0 0 0 0 1 69

214 0  831 3 2  0 0 0  22809 1 26  0 10  7 0 0 0 0 1 69

215 0  82811 1 122715  11609 0 30  0 20 10 0 0 0 0 0 69
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CARD COLUMNS
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216 0  2 3 0 2   0 0 0  1 369 1 17  0 10  4 0 0 0 0 0 69

217 0  325 6 1  4 5 9  1 969 0 24  0 20  6 0 0 1 0 0 69

218 1  828 8 1  51511  1 369 0 26  0 10 12 0 0 0 0 0 69

219 0  9 7 4 2   0 0 0  22869 1 26  0 10  6 0 0 0 0 1 69

220 0  912 2 1 1112 6  1 369 0 20  4 20  8 0 0 0 0 0 69

221 0  8 3 3 1 112511  22869 0 25  0 10  4 0 0 0 0 1 69

222 1  824 4 1  322 7  22869 0 26  1 10 11 0 0 0 0 1 69

223 0  111 7 1  9 227  11869 0 26  0 20 10 0 0 0 0 0 69

224 0 1125 8 1 112210  2 769 0 28  0 20  8 0 0 0 0 1 69

225 0  4 599 1  12616  1 369 0 25  2 10  4 0 0 0 0 0 69

226 1  52912 1  5 615  22869 0 34  0 10 13 0 0 0 0 1 69

227 0  22299 1  4 8 3  1 669 0 24  1 20  2 0 0 1 0 0 69

228 1  619 2 1  11817  22869 0 19  7 10 14 1 3 0 0 1 69

229 1  9 399 2  0 0 0  12369 1 26  0 10  4 0 0 1 0 0 69

230 0  5 1 7 2   0 0 0  52169 0 25  0 20  7 0 0 1 0 0 69

231 1 1027 2 2   0 0 0  61869 1 29  3 10  9 0 0 1 0 0 69

232 0 1012 0 2   0 0 0  61769 1 26  0 10  3 0 0 1 0 0 69

233 1 1221 0 1 1211 0  62769 0 17  5 10 15 1 3 1 1 0 69

234 0  531 6 1  610 7  41569 0 21  3 20  8 0 0 1 0 0 69

235 0  422 4 1  720 7  42369 0 27  0 20 10 0 0 1 0 0 69

236 1  2 5 9 2   0 0 0  5 569 0 34  0 10 12 0 0 1 0 0 69

237 1  425 3 1  5 9 6  4 369 0 27  0 10 12 0 0 1 1 0 69

238 1  91512 1  1 618  52469 0 29  3 10 13 0 0 0 0 0 69

239 0  419 4 1  425 9  61769 0 26  0 20 10 0 0 1 0 0 69
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CARD COLUMNS
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240 0  816 7 1  21512  43669 0 33  0 24  8 0 0 1 0 0 69
241 0  820 4 1  227 9  61269 0 28  0 24  7 0 0 1 0 0 69
242 0  1 7 7 1  7 717  6 269 0 18  5 24 11 0 0 1 1 0 69
243 0 12 3 5 1 1219 6  52069 0 22  2 20  6 0 0 1 0 0 69
244 0 1020 6 2  0 0 0  42969 1 17  0 10  5 0 0 1 1 0 69
245 0  819 3 1  52511  4 169 0 28  0 20 10 0 0 1 0 0 69
246 0  223 7 1  722 2  42669 0 26  0 20 10 0 0 0 0 0 69
247 0  313 7 1  5 610  61669 0 25  0 10  4 0 0 0 0 0 69
248 0 1014 8 1  823 6  41769 0 28  0 20  2 0 0 0 0 0 69
249 0  311 9 1  21212  7 969 0 26  0 10  5 0 0 1 0 0 69
250 0  9 3 9 1  51713  8 269 0 28  2 10 12 0 0 0 0 0 69
251 1  525 9 1  626 8  7 869 0 21 13 10 12 0 0 0 0 0 69
252 1  615 7 1  92515  7 259 0  6 20 10 13 1 2 0 1 0 69
253 0 1017 2 1  210 3  82669 0 27  0 20 11 0 0 1 0 0 69
254 1  211 9 2  0 0 0  71969 1 16  7 10 12 1 3 0 1 0 69
255 1  7 2 9 2  0 0 0  82969 0 27  0 10 12 0 0 0 1 0 69
256 1  6 910 1  12114  7 669 0 30  0 10 13 0 0 0 0 0 69
257 0  6 2 7 1  411 6  8 169 0 17  0 10 13 0 0 0 0 0 69
258 0  411 6 1  0 2 7  82669 1 27  0 10  7 0 0 0 0 0 69
259 0 12 2 6 1  819 3  7 869 0 28  5 10  8 0 0 0 0 0 69
260 0  131 1 1  818 4  71069 0 28  0 10  9 0 0 1 0 0 69
261 0 10 7 5 1  811 9  83169 0 28  0 20 10 0 0 0 0 0 69
262 0  720 3 1  524 2  9 869 0 28  0 20 10 0 0 1 0 0 69
263 0  817 6 1  915 9  7 269 0 28  0 10  4 0 0 1 0 0 69
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CARD COLUMNS
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264 1  3 4 6 1  5 312  91769 0  6 18 10 12 1 2 0 1 0 69

265 1 1117 2 1 1123 1  82169 0 30  0 10 11 0 0 1 0 0 69

266 0  2 1 7 2  0 0 0   2969 1 27  0 10  7 0 0 1 0 0 69

267 0  225 8 1  41925  71869 0 19  2 10  9 0 0 0 0 0 69

268 0  823 4 1  111 7 10 369 0 28  3 20 11 0 0 0 0 1 69

269 1 102114 1  4 113 103169 0 29  4 10 13 0 0 0 0 1 69

270 0 12 3 5 1  9 5 7 102969 0 27  0 20 10 0 0 1 0 1 69

271 0  916 9 1  92310 103169 0 30  0 20 10 0 0 1 0 1 69

272 0  331 4 1  412 5 103169 0 18  0 24  8 0 0 1 0 1 69

273 0 11 3 9 1  62611 103169 0 24  6 10 12 1 3 0 0 1 69

274 1  9 5 1 2  0 0 0 102069 0 27 11 10 12 0 0 1 1 1 69

275 1  927 5 1  42117 103169 0 27  3 10  9 0 0 0 0 1 69

276 1 10 1 4 1  4 710 103169 0 24  0 10 12 0 0 0 0 1 69

277 0  227 9 2  0 0 0 103169 1 26  0 20  6 0 0 0 0 1 69

278 0  3 5 9 1  310 9 103169 0 23  4 10  9 0 0 0 1 1 69

279 0  2 6 4 1  311 7 103169 0 27  0 20 10 0 0 1 0 1 69

280 0  6 8 3 1  3 2 9 103169 0 28  0 20 10 0 0 0 0 1 69

281 0  11510 1  71910 103169 0 32  0 24 14 0 0 1 0 1 69

282 0  12210 1 102916 103169 0 35  0 10 11 0 0 0 0 1 69

283 1 1225 9 1 122715 103169 0 30  0 10 13 0 0 0 0 1 69

284 0  727 0 1  630 7 103169 0 28  0 20  5 0 0 0 0 1 69

285 0  920 4 1  91910 103169 0 28  0 20  7 0 0 0 0 1 69

286 0  1 5 2 1 12 9 4 103169 0 27  0 20  9 0 0 0 0 1 69

287 1  8 4 5 1  12019 103169 0 13  4 10 12 0 0 0 0 1 69
```

```
CARD COLUMNS
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289 0  5 2 5 1  71010 101409 0 22  0 10  4 0 0 1 1 1 69

290 0  113 3 1  816 5 103109 0 29  0 20  9 0 0 0 0 1 69

291 1  410 7 1  9 817 103109 0 18 20 10 13 1 2 0 0 1 69

292 1  9 7 8 1  81219 103109 0 23  4 10 14 0 0 0 1 1 69

293 0  1 212 1  1 623 103109 0 32  0 20 10 0 0 0 0 1 69

294 1 1020 5 1 103014 103109 0 29  0 10 11 0 0 0 0 1 69

295 1  22710 1 10 4 9 103109 0 26  4 10 13 0 0 0 0 1 69

296 1  53014 1  52421 103109 0 29  4 10 13 0 0 0 0 1 69

297 1  726 9 1  9 1 6 103109 0 37  4 10 17 0 0 0 0 1 69

298 0 1112 2 1  4 319 102709 0 28  0 10  6 0 0 0 0 1 69

299 1  824 6 2  0 0 6 103109 1 25  0 10  4 0 0 0 0 1 69

300 0  9 7 8 1 102212 103109 0 32  0 20  6 0 0 0 0 1 69

301 0  124 2 1  41729 103109 0 26  1 20 10 0 0 0 0 1 69

302 0  624 7 1 101911 103109 0 29  0 20 10 0 0 0 0 1 69

303 0 10 9 9 2  0 0 0 103109 0 24  0 10  9 0 0 0 0 1 69

304 0  930 5 1  910 7 103109 0 25  3 20  9 0 0 0 0 1 69

305 0  115 0 2  0 0 0 103109 1 26  0 10  4 0 0 0 0 1 69

306 0 12 9 9 1  8 814 103109 0 21 20 10  9 1 2 0 1 1 69

307 0  5 8 6 1  3 5 0 103109 1 21  0 10  9 0 0 0 0 1 69

308 0 1226 5 1  1 7 7 103109 1 25  0 10  8 0 0 0 0 1 69

309 1  714 9 1  81012 103109 0 28  0 10  9 0 0 0 0 1 69

310 1 11 511 1  51021 103109 0 30  0 10 11 0 0 1 0 1 69

311 1  8 814 1 12 320 103109 0 34  1 10 12 0 0 0 0 1 69
```

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CARD COLUMNS
00000000011111111122222222233333333334444444444555555
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312 1  924 6 1  7 9 6 103169 1 19  0 10  4 0 0 0 0 1 69
313 0  915 8 2  0 0 0 103169 1 27  0 10  4 0 0 0 0 1 69
314 1  120 8 1  52815 103169 0 18 12 10 13 1 3 0 0 1 69
315 0 1116 5 2  0 0 0 103169 1 30  0 10  5 0 0 0 0 1 69
316 0  513 9 2  0 0 0 103169 1 29  0 10 11 0 0 0 0 1 69
317 0  211 8 1  52011 103169 0 23 10 10 13 1 3 0 0 1 69
318 0  727 2 1  5 8 7 103169 0 28  0 20  2 0 0 0 0 1 69
319 0  814 9 1  0 1 6 103169 1 28  0 10  5 0 0 0 0 1 69
320 1  323 5 1  711 7 103169 0 33  2 10 13 0 0 0 0 1 69
321 0  920 1 1 101394 103169 1 18  0 10  4 0 0 0 0 1 69
322 0 12 5 1 2  0 0 0 103169 1 17  0 10  4 0 0 0 0 1 69
323 0  81914 1  53115 103169 0 21 12 10 11 0 0 0 0 1 69
324 1  417 7 1  7 2 9 103169 0 24  4 10 12 0 0 0 0 1 69
325 1 1125 7 1 1112 6 103169 0 28  0 10 13 0 0 0 0 1 69
326 1  725 0 2  0 0 0 103169 1 19  0 10  5 0 0 0 0 1 69
327 0 12 8 6 1 1121 7 103169 0 30  0 20 10 0 0 1 0 1 69
328 0  120 9 1  32811 102969 0 28  0 20 10 0 0 1 0 1 69
329 0  815 4 2  0 0 0 103169 0 28  0 20  7 0 0 0 0 1 69
330 0 111799 2  0 6 0 103169 0 27  3 20  9 0 0 0 0 1 69
331 1 10 414 1  21815 102469 0 32  0 10 14 0 0 0 0 1 69
332 0  414 7 1  22110 103169 0 27  0 24 11 0 0 0 0 1 69
333 1 1127 8 1  4 6 8 103169 0 23  5 10 12 0 0 0 0 1 69
334 0 11 399 1  11522 103169 0 28  0 20 10 0 0 0 0 1 69
335 1  919 7 1 122010 103159 0 22  5 10 12 0 0 0 0 1 69
```

```
CARD COLUMNS
(0000000001111111112222222222333333333344444444445555555
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336 0   122 6 2   0 0 0 103169 1 27  0 20  6 0 0 0 0 1 69

337 0   525 6 1   8 8 9 103169 0 26  0 20 10 0 0 0 1 1 69

338 0   41994 2   0 0 0 103169 1 13  0 10  4 0 0 0 0 1 69

339 0   6 5 2 2   0 0 0 102769 0 27  0 20  9 0 0 0 0 1 69

340 0 111899 1   7 7 8 103169 0 29  0 10 11 0 0 0 0 1 69

341 0   910 2 2   0 0 0 121769 1 33  0 10  6 0 0 1 1 0 69

342 0 1227 1 1   9 4 7 123169 0 28  0 10  9 0 0 1 0 0 69

343 1   718 3 1   624 8 123169 0 35  0 10 12 0 0 0 0 0 69

344 0   2 7 6 2   0 0 0 12 869 1 28  0 10  7 0 0 1 0 0 69

345 0 123099 1   8 2 5 121969 0 30  0 20  3 0 0 1 0 0 69

346 0 1128 4 2   0 0 0   2 968 1 25  0 10  5 0 0 0 0 0 68

347 0   519 4 1   8 3 6   11268 0 17  0 10  7 0 0 0 0 0 68

348 1   4 8 2 2   0 0 0   32258 1 36  0 10  4 0 0 1 0 0 68

349 1 102610 1   12412   21968 0 31  3 10 12 0 0 1 0 0 68

350 1   82412 1 12 222   21768 0 30  4 10 13 0 0 0 0 0 68

351 0   1 7 2 1 10 9 7   1 668 0 26  4 20 10 0 0 0 0 0 68

352 1   61098 1   62323   12868 0 27  1 10 11 0 0 1 0 0 68

353 1 11 210 2   0 0 0   2 368 0 32  0 10 14 0 0 0 0 0 68

354 0   5 6 4 1   63113   13168 0 25  0 24  8 0 0 1 0 0 68

355 0 12 4 3 1   912 9   12868 0 27  0 20  3 0 0 0 0 0 68

356 0   1 9 7 2   0 0 0   12868 0 24  2 20  6 0 0 0 0 0 68

357 0   21513 1 12 715   3 868 0 24  6 20 11 0 0 0 0 0 68

358 0   314 3 2   0 0 0   1 568 1 19  0 10  5 0 0 0 0 0 68

359 0   411 2 1   11717   2 268 0 25  1 20  9 0 0 0 0 0 68
```

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CARD COLUMNS
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12345678901234567890123456789012345678901234567890123456789

360 1   622 6 1   92011   2 966 0 22   4 10 13 1 3 0 0 0 68
361 1   229 8 2   0 0 0   31558 1 26   0 10 12 0 0 0 0 0 68
362 0 1214 0 1 10 6 4   11266 0 16   1 20 6 0 0 1 1 0 68
363 0 113099 1 10 612   12668 0 17   0 20 7 0 0 1 1 0 68
364 1   2 7 8 1   614 5   21658 0 24   0 10 12 0 0 0 0 0 68
365 0   824 8 1 113010   3 568 0 31   5 10 14 0 0 0 0 0 68
366 0   313 2 2   0 0 0   21268 0 26   0 20 11 0 0 1 0 0 68
367 0   9 9 2 1 1217 4   31158 0 26   0 20 10 0 0 1 0 0 68
368 0   725 1 2   0 0 0   2 268 0 21   4 10 5 0 0 0 0 0 68
369 0   525 0 1 11 299   1 568 0 27   4 20 10 0 0 0 0 0 68
370 0   728 0 1   92393   1 968 0 16   0 20 10 0 0 1 0 0 68
371 1 102111 1   22113   21668 0 33   0 10 11 0 0 0 0 0 68
372 0   711 6 2   0 0 0   22958 0 28   0 20 5 0 0 0 0 0 68
373 0 1121 2 1 11 7 4   21968 0 23   3 10 9 0 0 0 1 0 68
374 0   830 5 2   0 0 0   22368 1 26   0 10 5 0 0 0 0 0 68
375 1   92712 1   42411   1 508 0 37   0 10 12 0 0 0 0 0 68
376 0 1021 6 2   0 0 0   31668 1 25   0 10 4 0 0 1 0 0 68
377 0   829 3 2   0 0 0   2 268 1 28   0 10 5 0 0 0 0 0 68
378 0   4 2 7 1   72114   3 858 0 26   0 20 10 0 0 0 0 0 60
379 0   9 3 2 2   0 0 0   42968 1 26   0 10 6 0 0 1 0 1 68
380 0   225 5 1   910 4   43068 0 26   0 24 5 0 0 0 0 1 68
381 0   72599 2   0 0 0   43068 1 17   0 10 4 0 0 0 0 1 66
382 1   717 0 1   2 512   42768 0 20   0 10 12 0 0 0 0 1 68
383 0   4 2 8 2   0 0 0   41368 1 26   0 10 5 0 0 0 0 1 68
```

```
CARD COLUMNS
0000000001111111112222222223333333334444444445555555
1234567890123456789012345678901234567890123456789012345

384 0  92999 2  0 0 0  45168 0 17  0 20  2 0 0 0 0 1 68
385 0  4 5 8 2  0 0 0  42758 0 27  0 24  6 0 0 0 0 1 68
386 1 1010 7 1 10 7 7  45068 0 16  6 10 11 0 0 0 1 1 68
387 1  327 7 1  72110  45068 0 27  0 10 14 0 0 0 0 1 68
388 0 1016 1 1  92999  41368 1 25  0 10  4 0 0 0 0 1 68
389 0 12 6 3 1  831 5  45068 0 26  0 24 10 0 0 1 0 1 68
390 1  4 210 1  72215  45068 0 29  2 10 14 0 0 0 0 1 68
391 0  519 3 1  222 4  45868 0 17  0 20 11 0 0 0 0 1 68
392 1  3 4 9 1 1023 7  45058 0 40  0 10 11 0 0 0 0 1 68
393 0  831 7 1  3 7 0  45068 0 39  0 20 10 0 0 1 0 1 68
394 0 1111 6 1  612 9  42468 0 33  0 10 12 0 0 0 1 1 68
395 1  825 5 2  0 0 0  45068 1 25  0 10  9 0 0 0 1 1 68
396 0  3 9 4 1  623 5  42658 0 17  0 20 10 0 0 0 0 1 68
397 0  821 5 2  0 0 0  45968 1 28  0 20  6 0 0 0 0 1 68
398 0  816 3 1  2 4 1  42608 1 25  0 10  3 0 0 0 0 1 68
399 1  319 6 1  51911  42668 0 28  4 10 13 0 0 0 0 1 68
400 0  6 5 2 1 11 7 2  41768 0 26  0 20  9 0 0 0 0 1 68
401 1 1125 4 2  0 0 0  42668 1 24  0 10 11 0 0 0 0 1 68
402 1  515 5 1  9 114  45068 0 26  0 10 13 0 0 0 0 1 68
403 0  52199 2  0 0 0  45068 1 22  0 10  4 0 0 0 0 1 68
404 0  7 199 1 1025 3  41068 0 22  0 20  8 0 0 1 0 1 68
405 0  712 2 2  0 0 0  45068 1 30  0 10  5 0 0 0 0 1 68
406 1  714 6 1 101313  42468 0 28  0 10 13 0 0 1 0 1 68
407 0  320 0 2  0 0 0  45068 1 24  0 10  4 0 0 0 0 1 68
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400 0  9 5 5 1 10 7 1   43366 0 28  0 10  3 0 0 0 0 1 66
409 0  7 9 6 1  924 6   43098 0 30  0 10  9 0 0 0 0 1 66
410 0  513 5 1  92298   43366 1 30  0 10  5 0 0 1 0 1 66
411 0  71398 1  1 198   43056 0 27  0 10  9 0 0 0 0 1 66
412 1  72511 1  314 8   41268 1 31  0 10  9 0 0 0 1 1 66
413 0 1128 3 2  0 0 0   42658 1 27  0 20 10 0 0 0 0 1 66
414 0  610 0 1  521 6   41356 0 26  0 20  6 0 0 1 0 1 66
415 0  4 2 6 2  0 0 0   43468 1 20  0 10  4 0 0 0 0 1 66
416 0  515 3 1  916 5   41758 0 23  0 20  9 0 0 1 0 1 66
417 1 1227 8 1  8 215   42606 0 33  0 10 14 0 0 0 0 1 66
418 1  312 4 2  0 0 0   43868 1 25  0 10  5 0 0 0 0 1 66
419 0  723 8 1  5 515   41968 0 30  0 10 13 0 0 0 0 1 66
420 0 10 2 5 1 1224 9   43868 1 18  0 10  5 0 0 1 0 1 66
421 0  52898 2  0 0 0   43058 1 25  0 20  4 0 0 0 0 1 66
422 1  629 7 1  525 6   43068 0 34  0 10 13 0 0 0 0 1 66
423 0  528 7 1  21710   43806 0 25  2 20 10 0 0 0 0 1 66
424 1  82511 2  0 0 0   43308 0 32  6 10 12 0 0 0 0 1 66
425 0 12 7 7 1  5 514   42608 0 26  0 20 10 0 0 0 0 1 66
426 0  429 7 1  41512   43868 1 26  0 20  2 0 0 0 0 1 66
427 1  320 7 2  0 0 0   52958 1 20  0 10  4 0 0 0 0 0 66
428 1  8 1 7 2  0 0 0   61468 1 27  0 10 11 0 0 1 0 0 66
429 0 1110 5 1  928 5   63868 0 14  1 20 10 0 0 1 0 0 66
430 0 1113 0 1  717 2   61468 0 33  0 24  1 0 0 1 0 0 66
431 0  3 4 5 2  0 0 0   62868 1 17  0 10  4 0 0 1 1 0 66
```

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CARD COLUMNS
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432 0 1122 2 1  31315  7 103 0 26  0 24 10 0 0 1 0 0 60
433 0  729 8 1  110 4  72966 1 20  0 10  4 0 0 1 0 0 60
434 0  616 8 1 1126 8  82208 0 30  0 24 12 0 0 1 0 0 60
435 0 1211 6 1 1030 8  71068 0 24  0 10 11 0 0 1 1 0 60
436 1  8 1 4 2  0 0 0  83168 0 21  5 10 14 1 3 0 0 0 60
437 0  821 7 1  3 225  72166 0 28  0 20 10 0 0 1 0 0 60
438 1  9 9 0 1  7 2 0  72068 0 17  3 10 12 0 0 0 1 0 60
439 1  120 0 1  515 9  83168 0 25  0 10  5 0 0 0 0 0 60
440 0  630 6 1 1111 9  71368 0 26  0 20 10 0 0 1 0 0 60
441 0  419 2 1  1 7 8  82068 0 20  0 20 10 0 0 1 0 0 60
442 1  91212 2  0 0 0  7 961 0 28  4 10 13 0 0 1 0 0 60
443 1  5 313 2  0 0 0  8 668 0 32  0 10 14 0 0 0 0 0 60
444 0  350 0 2  0 0 0  81668 1 25  0 10 14 0 0 0 0 0 60
445 0  4 3 7 2  0 0 0  7 108 0 27  0 24 11 0 0 1 0 0 60
446 0  9 6 6 1  52410  81168 0 27  0 20 10 0 0 1 1 0 60
447 1 112010 1  61316  9 268 0 26  7 10 14 0 0 0 0 0 60
448 0  817 6 2  0 0 0  9 668 1 24  0 10  3 0 0 0 0 0 60
449 1  612 1 1  02324 103168 0 13 31 10 12 1 2 0 0 0 60
450 0  115 1 2  0 0 0  91868 1 26  0 10  6 0 0 1 0 0 60
451 0  719 8 1  311 5  92768 1 27  0 22  5 0 0 0 0 0 60
452 0 1121 5 1  128 8  9 968 0 25  3 20 10 0 0 1 0 0 60
453 1  916 8 1  827 1  91668 0 20  0 10 12 0 0 1 0 0 60
454 1  8 7 6 1  52710 103168 0 12 20 10 12 1 2 0 1 0 60
455 0  514 4 1  21627 102968 0 26  0 20  9 0 0 1 0 0 60
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CARD COLUMNS
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1234567890123456789012345678901234567890123456789012345

456 0  625 4 1 1029 2 11 408 1 36  0 10  4 0 0 0 0 0 60

457 0  927 6 1 1116 1 12 708 1 22  0 10  5 0 0 0 0 0 60

458 0  519 5 1  920 3 102608 1 19  0 10  5 0 0 1 0 0 60

459 1 113099 2  0 0 0 122308 1 25  0 10  6 0 0 0 0 0 60

460 1 1129 6 1  9 917 111908 0 30  0 10 12 0 0 1 0 0 60

461 1  428 2 2  0 0 0 102608 1 27  0 10 12 0 0 0 0 0 60

462 0  711 7 2  0 0 0 12 108 1 21  0 10  9 0 0 0 1 0 60

463 0  1 613 1 111415 10 406 0 27  4 10  9 0 0 1 0 0 60

464 0  711 4 1  121 8 10 908 0 24  6 24  8 0 0 1 0 0 60

465 1  22711 2  0 0 0 11 708 1 32  0 10  7 0 0 1 0 0 60

466 0  412 4 1  32717 121108 0 23  0 20  7 0 0 1 0 0 60

467 0 11 2 1 1  9 5 4 11 808 0 26  0 10  7 0 0 1 0 0 60

468 0 11 1 3 1  7 7 6 123108 0 16  0 20 10 0 0 0 0 0 60

469 0 1117 6 1  12411 112708 0 18  0 20 10 0 0 0 0 0 60

470 0 1230 9 1 11 922 10 708 0 22  6 10 12 0 0 1 0 0 60

471 0  7 6 6 1  12014 102308 0 26  0 10  7 0 0 1 0 0 60

472 0 1217 0 1  21213 112908 0 29  0 20 10 0 0 1 0 0 60

473 0  3 5 2 1  222 5 112705 0 32  0 20  9 0 0 0 0 0 60

474 0 1227 3 1  519 6 122708 0 26  0 20  7 0 0 0 0 0 60

475 0  914 8 2  0 0 0 12 708 1 28  0 10  7 0 0 0 0 0 60

476 0  2 6 9 2  0 0 0 122308 1 30  0 10 11 0 0 0 1 0 60

477 0  9 7 8 1  3 5 7 10 208 0 28  0 20 10 0 0 1 0 0 60

478 0  1 3 3 1  11996 12 608 1 17  0 10  5 0 0 0 0 0 60

479 0  521 6 1  610 0 121308 1 20  0 20  2 0 0 1 0 0 60
```

```
CARD COLUMNS
00000000011111111112222222223333333333444444444455555
12345678901234567890123456789012345678901234567890123
480 0  629 8 1  3 213 102458 0 41  0 10  7 0 0 1 0 0 60
481 0  820 4 2  0 0 0 121768 1 29  0 20  6 0 0 0 0 0 68
482 0  425 5 1  723 7 101468 0 33  0 10  6 0 0 1 0 0 68
483 0  5 9 3 2  0 0 0 122958 1 27  0 10  4 0 0 0 0 0 68
484 0  2 5 2 1  71612 103168 0 26  1 20  2 6 0 1 0 0 60
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4 DESCRIPTIVE NOTES (Type of report and inclusive dates)
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11 SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY

13 ABSTRACT

A model capable of predicting civilian optional retirements with a high degree of accuracy was needed by AFLC personnel planners. In this study, such a model was constructed by regression analysis techniques. Data for the study came from a sample of 484 AFLC civilian retirements at Wright-Patterson AFB, Ohio. Appropriate parametric and nonparametric statistical analyses were used to determine those variable factors which affect the retirement decision. Those factors which were found to have a strong correlation to the age of retirement were then used as predictor variables in the regression models constructed. It was found that retirements could be accurately projected.

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Civilian Personnel

Retirement

Personnel Management

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